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MODERN MEDICINE;

CONTAINING

A BRIEF EXPOSITION

OF THE

PRINCIPAL DISCOVERIES AND DOCTRINES THAT HAVE OCCASIONED
THE RECENT ADVANCEMENT OF

MEDICAL PHILOSOPHY,

WITH STRICTURES ON THE PRESENT STATE OF

MEDICAL PRACTICE;

AND

*An Enquiry how far the Principles of the Healing Art may
become the Subjects of unprofessional Research.*

> "Media quodammodo inter diversas sententias." CELSUS.

By DAVID UWINS, M. D.

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AUTHOR OF THE MEDICAL ARTICLES IN DR. GREGORY'S ENCYCLOPŒDIA.

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For the Library of
the Medical Society
from the Author

Printed by William Norman, Aylesbury.

TO

BENJAMIN BATES, M. D.

LITTLE MISSENDEN, BUCKS.

Dear Sir,

WHEN I requested permission to affix your name to the present little Treatise, I was conscious of soliciting a more than ordinary favour. Indeed were there necessarily "some accord between the character of a work and that of the patron to whom it is presented," such request would have implied equal inconsistency and presumptuousness.

To you, Sir, who have retired from the toils of the profession to classic ease and elegance, medical works, even from writers of established character, must have ceased to be interesting. Whatever then may be my wish, I have no right to expect that this address be considered (as prefatory addresses *usually are)* a letter of introduction *to the pages that follow.*

I have only to embrace the opportunity allowed me of publicly expressing my proud and grateful sense of the private *and in every import of the word unprofessional kindness which has been shewn me, since my residence in this place, by a physician who, I believe, was the first to reside and practise in the county of Buckingham.*

Permit me to subscribe myself,

Dear Sir,

Your's most respectfully and sincerely,

David Uwins.

Aylesbury, Bucks,
Sept. 23, 1808.

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MODERN MEDICINE.

CHAPTER I.

INTRODUCTION.

A Prominent characteristic of the present times is a species of intellectual democracy, constituted by that spirit of universal investigation, that indifference to prescription, and defiance of authority, which we find conspicuously prevalent, not only in respect to the cultivation of literature and general science, but which has extended its influence over the professions, and has perhaps more especially operated upon the profession of medicine. Physicians indeed of our day seem almost a different race from physicians of former periods. Peculiarity of deportment, and gravity of aspect, have much less weight upon the reflecting part of the community, and even the "profane vulgar" are not in the same measure affected by "the pride, and pomp, and circumstance" of physic.

To inquire into, and make a comparative estimate of the advantages and disadvantages which have respectively grown out of this order of things, were to be employed in a research of no mean moment. The result, it is feared, of such disquisition, would scarcely serve to justify the enthusiastic and unlimited encomiast of modern times and modern manners; it would most assuredly stand opposed to the wild speculations of some few individuals who have argued the progressive march of human improvement, and taught the absolute perfectibility of human nature.

This path of investigation is not, however, the track which it is my intention at present to pursue; and, it is merely necessary in this place to speak of one consequence of the change in public sentiment alluded to, as it relates to the profession of medicine. I mean the establishment of scepticism upon the ruins of mystery. Man is proverbially prone to extremes and to error: it is, moreover, a singular fact, that the same constitution of mind which favours implicit belief, facilitates also the influence of doubt. Those optics which are most easily dazzled by exterior splendour, and artificial colouring, are by this process blinded to the interior and essential, when the exterior and adventitious are removed. The curtain is drawn and all behind it is a blank. The awfully obscure of medicine is abrogated, and therefore "Medicine itself is a mere trick."

In this respect we find the history and fate of physic to bear a pretty exact correspondence with that calling, the objects of which are incomparably more momentous than even medicine itself; and, as the requisitions of the times summon the divine not to assert magisterially, but to give a *reason* for the hope that is in him, so it devolves upon the medical professor to silence cavil and crush suspicion by a fair and open avowal of his claims to public respect and confidence. To appeal then from the misconception of the ignorant, and misrepresentation of the inimical, to the good sense and candour of the public, was my principal object in the execution of the present treatise, which is intended to convey such information respecting the science and practice of medicine, as, while it instructs the professional student, shall interest the man of general intelligence; while it endeavours to collect and fashion into one body the various members of which modern medicine is composed, will, at the same time, attempt to mould this mass into such form as not to terrify the uninitiated beholder.

In fine, it is my wish to give such a general view of the medical art, as, not intended solely for the public, shall be open to public inspection; to state the grounds upon which is argued the improved condition of this art, to shew that "medicine need only be better known to secure the esteem of mankind," and to draw that line of distinction, which exclusively of artifice, and independently of interest, must ever divide the professional from the popular cultivation of medical philosophy.

CHAPTER II.

ONE of the most elegant and sensible writers of antiquity has asserted, that medicine and mankind must have been coeval in their origin: "Medicina nusquam non est"—an assertion which no one surely will attempt to question, who allows its proper definition to be that of curing or alleviating disease; for subjection to physical as well as moral evil has always been the lot of humanity.

But to ascertain the precise period at which medicine came to be cultivated as a branch of pursuit is exceedingly difficult, if not impossible; and, even for a considerable time subsequent to this period, the principles and practice of the art were so much involved in fable, and obscured by fiction, as scarcely to be recognised.

Before the æra of the Greek philosopy and refinement, Egypt was most remarkable for men who, with the sacerdotal office, combined pretensions to the power of healing the maladies of the body; this perhaps may be accounted for, partly by the more than common influence which the priests possessed over the inhabitants of that country, and partly from its soil being especially productive of those plants which instinct, accident, or imitation, gradually discovered to possess healing properties.

From Egypt, Phenicia, and Thrace, Greece was principally colonized; that country which was destined to form so conspicuous a figure on the theatre of the world—to be in a manner the origin of civilized, at least of embellished society, and to give birth to the man who has been emphatically, and with some justice, entitled the Father of Medicine.

Religion and medicine continued for a long time in the hands of the same individuals. In Greece, as in Egypt, the art of healing the sick was at first cultivated in the temples, nor can we be surprised either at the easy faith of the public, or the success with which the priests prescribed, when we advert to the almost unlimited power of fanaticism and imposture, both in religion and medicine, over the minds, ay, and the bodies of men, even in the present day of boasted freedom, from the stratagems of the designing few. It is worthy notice, that the Greek word φαρμακον, from which we derive the English appellative of pharmacy, literally signifies a charm; and how many are there of modern maladies which, obstinately resisting the pharmacy of our shops, yield with facility to the pharmacy of the Greeks. The quackery of the priests of Esculapius, and that of the proprietor of metallic tractors, however they may differ in form, are the same in effect.

Medicine thus continued to be united to religion, until the curiosity characteristic of man, when in any degree elevated above the mere sensuality of savage existence, induced him to enquire into the causes of those phenomena of which nature is so abundant in its display. But with the desire of knowledge, an almost entire ignorance of the mode in which to obtain it characterized what is called antient philosophy, in which conjecture stood in the place of experiment, and fancy supplied the absence of truth. Hence the numbers of Pythagoras, the figures of Democritus, the fire of Heraclitus, the forms of Plato, and the elements of Aristotle, which were made use of in order to explain appearances in the material world, as well as to elucidate the functions and diseases of the animal œconomy.

Under these circumstances Hippocrates appeared. The predecessors of this great man had laudably rescued the study of medicine from the poets and the priests; he was the first to impress upon it the character of a distinct science. "Ab studio sapientiæ disciplinam hanc separavit."

The principal merit of Hippocrates consisted in independence of judgment and originality of observation. "He studied life and disease in the book of nature," rather than in the dogmas and precepts of the schools. Although comparatively, he was not, however, totally, free from the errors of the times. We can trace the numbers of Pythagoras in his doctrine of critical days, and the elemental philosophy of Aristotle in his physiological and pathological reasonings. We find, in various parts of his works, heat and nature used in a vague irrational sense, and in a manner identified with intelligence; faults, however, which are more than venial, when we consider the time in which he lived.

For many years after the death of Hippocrates, while the auxiliaries of medicine, more especially anatomy, were making considerable advances, the general body of the science was deformed and mutilated. Asclepiades attempted a restoration of the atomic doctrines of Epicurus, and "by means of corpuscules and pores explained every thing;" from the remains of his, arose the methodical system of medicine, which referred all the derangements of the animal œconomy to the condition of the fibres; these the methodists regarded as in some instances too much constricted, in others too much relaxed, while sometimes they were in a mixed state.

On the doctrines of the methodists we find the following judicious remarks in a modern writer of a neighbouring nation. "We may form (says M. Cabanis) some idea of what they meant to designate by the term *diseases of constriction;* though it certainly is not so intelligible to men of science as it appears to the uninformed class; we may also conceive the meaning of the phrase *relaxed fibres;* but it is difficult to divine, what they could understand by their mixed species, or how they could apply to practice this speculative notion, which is so very subtle as to elude all conception. Besides, is it not evident that all diseases belong to the *mixed class*, or may be referred to it? For this word, if it signify any thing, must mean an *inequality of tone* in the different organs, or an irregular distribution of the vital power, so that certain parts may be in a state of constriction, while others are in a state of relaxation. Now the majority of diseases present the general phenomena of a derangement in the equilibrium, or irregular expenditure of living energy. In those cases in which these deviations from the healthy standard are less obvious, an observing eye may still perceive them; and, perhaps there is no disease in which a deficiency of equilibrium is not in some degree manifested, whether it be in the tone of the different organs, or in the exercise of life and distribution of the sensibility of the system. Thus, then, the *mixed species* of the methodic sect, by comprehending every thing, becomes, in fact, applicable to nothing."

Medicine was at this time divided into three sects—the methodic of which I have just spoken; the dogmatic which long preceded it, and which retained its faith in the now justly exploded philosophy of the schools; and lastly the empiric, which disregarded and derided all other instruction but that of experience. The merits and demerits of these different systems, I shall have an opportunity shortly to canvass while enquiring into the true meaning and legitimate application of the much abused word—experience.

From the period of the first establishment of the methodic sect, to the time of Galen, we find the history of medicine to be merely the history of party commotion and petty warfare. Galen was born at Pergamus, fully five hundred years subsequent to the death of Hippocrates, whose name he venerated, and whose system of medicine he professed a wish to restore. The comments, however, of Galen, on the precepts of his master, were too frequently misrepresentations of his meaning; and, in endeavouring to illustrate the doctrines of Hippocrates, he often obscured their import.

Galen supposes the existence of four humours, from the deficiency or redundancy of which depend both constitutional character and the various maladies to which different constitutions are especially obnoxious. These humours are the blood, the phlegm, the yellow bile, and the black bile. He also conjectures the existence of three distinct kinds of spirits—the natural, the vital, and the animal; the first of which is supposed to be a subtle vapour arising from the blood, and, being conveyed to the heart, constitutes, when mixed with the air received by the lungs, the vital, which are converted into the animal spirits in the brain. These three kinds of spirits are believed to serve as instruments to respective faculties, viz. the natural, the residence of which is the liver, and which presides over and regulates nutrition, growth, and generation; the vital, which has its seat in the heart, and which communicates warmth and preserves vitality; while the animal faculty our author lodged in the brain, and supposed it to be the immediate cause of sensation and motion, and at the same time to govern and direct the other faculties, all being subordinate to one primary impulsive principle—Nature.

It is customary for those who write the history of medicine to pass over, as scarcely demanding notice, the intermediate period from the time of Galen to the epoch of the Arabians. During the prevalence of ignorance and barbarism through every part of the Roman empire, philosophy took refuge among the Saracens, The school of Alexandria, which had long been in repute, was still the resort of students from all quarters of the world, when Egypt was conquered by the Arabians, and the Alexandrian library became a prey to the furious fanaticism of the followers of Mahomet. The destruction, however, was not total; several books were saved, and especially those which treated of medicine and natural philosophy.

The works of Aristotle, of Galen, and Hippocrates, were translated into the language of the Arabians, but for those of the two former, as more in unison with their own modes of philosophizing, the Saracens almost invariably evinced a decided preference.

Medicine is perhaps no otherwise indebted to the Arabians, than in the addition they made to the science of botany, and their introduction of several articles into the materia medica which were till then unknown, and are now in use.

It was not till after many ages, that the light of learning was restored to Europe; this was partly occasioned by the intercourse which the crusades established between the Europeans and the Saracens; and at length the revival of letters in Italy was fully effected in consequence of the capture of Constantinople by the Turks. As learning, during the convulsions of the Roman empire sought an asylum in the east, it now, after the lapse of much time, took refuge in its former abode. The Arabian philosophy and medicine were deprived of their usurped claims, and it was discovered that almost all this people had of valuable, either in science or art, were gross plagiarisms from the antient Greeks and Romans.

The chemical æra of medicine, which shortly followed the revival of learning in Europe, seems however to have had its origin in Saracenic philosophy. The first alchemists were from among the Saracens; and it is by some supposed that those writings, which were not devoted to destruction at the time when the Alexandrian library was with this exception consumed, were saved from a notion of their containing secret information respecting the art of converting metals into gold, of curing all maladies by a single remedy, and of conferring immortality on man.

At the head of the European alchemists stands Paracelsus, a man whose temperament and talents were both such as were calculated, especially at the time in which he flourished, to awe the minds of the vulgar and extensively to influence public opinion. The Greek, Latin, and Arabian works were all without exception, not only proscribed, but treated by Paracelsus with the utmost derision; and the present day is not wanting in examples of fame being grounded upon an affected contempt for that learning which the contemner has either not discrimination to appreciate, or wants inclination or opportunity to pursue.

With Paracelsus and those of his sect, all was chemistry, but a chemistry widely different, both in its first principles and in its practical application, from that truly legitimate and useful science which in the present day bears this appellation. The terms of effervescence, ebullition, fermentation, and deflagration, were, without any precise signification, all pressed into the service of the medical art. Amidst this confusion, however, several valuable truths were elicited, and several remedies introduced into practice, which, but for the incautious temerity of the alchemists, might have still remained untried and unknown.

Early in the seventeenth century, Dr. W. Harvey, of London, first communicated to the world the discovery of the circulation, which always and deservedly ranks among the most important discoveries of modern philosophy, the credit of which belongs by right to Harvey, however the fact may have been obscurely hinted at, or partially anticipated by others, and which overthrew at once the vast fabric of Galenic reasoning, while at the same time it exposed the absurdity of alchemic hypotheses.

The advantages, however, which followed the development of the doctrine in question, were in the first instance rather negative than positive. Out of the ruins of the antient arose modern errors. The demonstration of Harvey happened to square with the geometrical genius of the times, and all medicine was now mathematics, hydraulics, mechanism, and laws of motion. The reader will form some idea of the futility of this species of philosophy, when he is told that while by one the power of the heart is estimated at a few ounces, another calculates it at one hundred and eighty thousand pounds!

Previously to mentioning the discovery of the circulation, and the doctrines which grew out of this discovery, it would perhaps have been more in order to have noticed the exertions of two German professors, of some celebrity, to effect a revolution in medical reasoning and practice.

Every one who is acquainted with the history of chemistry, is familiar with the names of Van

Helmont and Stahl; the first of whom is considered the last of the alchemists, and whose "death completed the disgrace of the universal medicine." Van Helmont, attentive to the connection of the stomach with almost all the maladies of the body, formed an obscure kind of conception that the vital principle resided in or about this organ, to which he applied the name of Archœus; he supposed that this had the superintendence of every other inferior principle connected with the phenomena and functions of life; that the business of the physician is chiefly to study the requisitions of this central principle, while attention is at the same time to be given to the subordinate ones; and that the art of medicine consists in knowing how to call them into action when deficient, or of repressing their inordinate activity, when they have been preternaturally excited.

The theory of Stahl is more general and metaphysical. This last professor was not so solicitous to discover the residence of the superintending principle, as to prove its rationality. His theory is shortly as follows; that the rational soul of man has the government and management of his body; that by virtue of its intelligence, perceiving the tendency of noxious agents, it obviates their malignity, by exciting such motions in the body as are calculated to operate this effect; that what we call disease is an effort of nature, in fact, to overcome disease; and that the physician has only to observe, and if necessary regulate the aberrations of this conservative—restorative power.

The learned and justly celebrated Boerhaave came forward as the Galen of the moderns, with a professed intention of reviving Hippocratic medicine, and adding to it all that was valuable in the science of the times. With a passionate ardour for chemistry of a more sober and legitimate cast than that to which we have above referred, and a respectful attachment to the almost forgotten antients, he framed a theory of medicine, which principally turning upon the chemical changes that take place in the solids, but more especially in the fluids or humours of the body, has been denominated the humoral pathology. While the process of curing diseases, according to the archœan and autocratic theory of Van Helmont and Stahl, consists in observing and regulating nature, in the system of Boerhaave, it is the correction or expulsion of different species of acrimony, or of morbid viscidity on the one hand, and tenuity on the other, in the component parts of the physical frame.

Hoffman, another name of deserved celebrity among medical systematics, proposed and acted upon a theory very different from that of Boerhaave, arguing that the changes both in the quantity and quality of the animal fluids, are consequent upon, and not the primary cause of, changes induced in the living fibre or solidum vivens. "Universa pathologia longe rectius atque facilius ex vitio motuum microcosmicorum in *solidis*, quam ex variis affectionibus vitiosorum *humorum* deduci atque explicari possit." This has been, perhaps, properly said to be the old methodical doctrine, to which I have previously referred, modified by the opinions of Hippocrates and the modern discoveries in chemistry. It is the theory which gave birth to that adopted and taught in the Edinburgh university; a theory which referred the origin of diseases to a kind of spasmodic stricture of the small or extreme vessels, which was supposed to create a reaction of the larger vessels, and thus produce the commotion by which disease is constituted; and it certainly approaches nearer in its character to that system of medicine, the merits and defects of which I purpose canvassing more at large in a separate chapter. It will be proper, however, first to enquire into the nature and objects of system, as well in reference to that particular science to which our attention is principally to be directed, as to the acquisition of knowledge in general.

Should any unprofessional reader have ventured thus far, he will, I am apprehensive, be disposed to accuse me of having directly departed from my original proposal of giving an air of popularity to the present work.

May I request such reader's further indulgence of accompanying me a little longer on the road, before he gives way to the tedium of travelling, or breaks out into exclamations on the barrenness of the prospects.

CHAPTER III.

IN the preceding chapter, I have endeavoured to trace the successive revolutions in medical theory in as general a manner as the subject would admit, for the purpose of rendering intelligible the following remarks on the much agitated and still contested question concerning system and experience.

There is, and always has been, a class of men who indiscriminately decry the one and laud the other; who contemn reasoning and commend empiricism—not perhaps aware that experience and empiricism, the Gods of their idolatry, are themselves system. To experience, is to know; to know, is to infer; to infer, is to reason; and to reason, is to systematize. A system, in its proper signification, is not then an invention, but "a scheme which unites many things in order, and it is thus impossible not to systematize;" for to learn, we must not merely observe, but we must collect, connect, arrange, and compare; from this collation and arrangement, we come to make certain deductions, which deductions constitute the whole of our knowledge.

It is indeed this capacity for generalizing particulars, and deducing inferences, that elevates man above the brute, and stamps him with the character of rationality. The brute is furnished with senses to observe, and capacity to recollect; but this observation, and this recollection, are confined to particular facts and unconnected events. He is not led by one phenomenon to the observation of another, and thus induced "to register the two as similar appearances."

It is the abuse, and not the use, of system, to which any objection can with propriety be advanced; and here, there is ample scope, so many are the sources of fallibility in man, for much and weighty objection.

The numerous causes of error to which a system is obnoxious, may perhaps be included under four general heads, to which, for want of more appropriate terms, we may apply the denominations of Empirical, Hypothetical, Metaphysical, and Physical *.

The first may be defined that system which makes wrong inferences or hasty deductions, either from an omisssion or erroneous arrangement of some of the materials out of which it is formed. Thus, if I find opium to relieve pain, and meeting with pain in another individual, I find the same effect result from its administration; if, in consequence of these observations, I predicate of opium that it is universally an anodyne, I come to a conclusion that is empirical.

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* I am sufficiently aware that the second of the above epithets does not in strict propriety stand opposed to the two succeeding: but, still as more explicative of my meaning than any others which occur to my mind, I have been disposed, for the sake of clearness, to pass over this apparent inconsistency.

An hypothetically erroneous system is that which draws conclusions from a supposed, but not justly, conceived similarity between phenomena that are not so immediately obvious to our senses. Thus, if discontented with the mere circumstance of pain being mitigated by opium, I ascertain some other effects which have followed its use, and infer that it is by virtue of its producing these latter the former has been occasioned, my inference is hypothetical.

A system which is metaphysically erroneous, is formed upon our supposed capacity of penetrating into the arcana of nature in a manner that is denied to human intellect, or, as it has been well expressed, from "the groundless belief that we are acquainted with the nature of causation*;" a belief, which led the antients into all their mistakes, and engendered that barbarous abuse of human powers, which goes under the name of scholastic philosophy.

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* See Preface to Observations on Darwin's Zoonomia, by Thomas Brown, Esq.

The physical errors of systematizing are constituted by endeavours to adapt the terms and apply the doctrines of one department of science to that of another, the phenomena and laws of which are widely different, and of using words to express facts, without having previously attached a precise signification to the words themselves.

If there be any justice in these observations, they will serve to shew the futility and presumptuousness of that spirit which opposes experience to reasoning, and prefers empiricism to system. But as the establishment of these principles is singularly important with reference to the cause I am to advocate, namely, the superiority of modern to antient medicine, I must beg the reader's patience while I resume each of the above definitions, and treat of them a little more in detail.

An anecdote by the late Dr. Moore, just now occurs to my recollection, which, unless I am much mistaken, will well serve to illustrate the nature of mere experience. A French student of medicine lodged in the same house in London with a man in a fever. This poor man was continually teazed by the nurse to drink, though he nauseated the insipid liquids that were presented to him. At last, when he was more importunate than usual, he whispered in her ear, "For God's sake bring me a salt herring, and I will drink as much as you please." The woman indulged him in his request; he devoured the herring, drank plentifully, underwent a copious perspiration, and recovered. The French student inserted this aphorism in his journal. *A salt herring cures an Englishman in a fever.* On his return to France, he prescribed the same remedy to the first patient in fever to whom he was called. The patient died; on which the student inserted in his journal the following caveat. N. B. Though a salt herring cures an Englishman, it kills a Frenchman.

The above affords a fair specimen of the inferences that are formed and practice that is directed by mere empirical experience; and let the reader lay it to heart, who is accustomed to censure reasoning as an unnecessary appendage to practical observation. If the narrative be invented, it is at least well conceived, and is a fair sample, as I have just observed, of daily occurrences—of collection of facts without arrangement and without judgment.

Will the reader permit me to extend the illustration of the point in question a little further? We will suppose an individual to be afflicted with that malady which is properly regarded the endemic of Britain—a cough; this disorder shall be remedied or cured, by the use of any medicine to which the subject of it may have been accidentally directed. Now this remedy becomes, perhaps, in his mind, a remedy for cough universally—a specific; and what reasoning can be more fair, what inference more obvious, than that if I am relieved of a certain malady by a certain medicine, my neighbour having the same malady, has only to make use of the same corrective? Here is observation, deduction, system; but unfortunately it is miserably defective in the materials from which it is manufactured. The inference is of the same nature with the Frenchman's axiom, inasmuch as those disorders which by the use of a generic term are identified, may have no more real alliance than Corœbus had to the Greeks when concealed by the armour of Androgeos.

I have been induced to prefer the example of cough before any other derangement in the œconomy, because it is one of the most common subjects of melancholy mistake on the part of the public, and because I have an instance now fresh in my memory, which marks the principle I am aiming to establish with the strong character of afflictive truth. The instance to which I allude is that of a poor man who has just come to me from a neighbouring village in the last and hopeless stage of a consumption, which has succeeded to inflammation of the lungs, that inflammation having been principally characterized by a frequent cough; for this cough he was advised to take some quack medicine (I have never the least concern to enquire what such medicine is), which added artificial to diseased irritation, and the lungs have run into that extent of ulceration, which is far beyond the reach of, at least, our present acquaintance with remedial agents. Now the distressing part of this case consists in the poor fellow having been prevented from timely application to proper and probably then effective sources of relief, by the hope of recovery from that medicine which in another had relieved a cough.

To some of my readers an apology may here be due for engaging in a discussion of truths which are so exceedingly obvious; to others, however, I shall not have tendered an unacceptable service, by opposing in toto the principle of quackery, not of objecting as the manner of some is to individual articles which have obtained the letters patent of government. The whole system is absurd and dangerous, let the merit or demerit, the virtuous or poisonous qualities of the substances employed be what they may, however designated or however charged, whether mineral or vegetable, whether sold at half a crown or the more politic price of half a guinea the bottle—more politic, because medicine, like other ware, is by many valued in the ratio of its cost.

Before I quit this part of my subject, and I shall have again to refer to it when treating on popular medicine, it may be proper to meet and oppose the charge of interested incentives which perhaps may be preferred against an individual of the profession for thus entering his protest against unprofessional and empirical practice. In reply to this objection, I do most sincerely affirm my belief in the advantage to the profession, as far as mere motives of interest are concerned, from the increase of irregular practitioners. Ask the well instructed and ingenious watch maker, whether the multiplication of pretenders to, without a knowledge of the mechanism and requisitions of a time piece, were more to his injury or advantage? In precisely the same predicament to the regulars in medicine stand in relation to quacks, excepting that their feelings are more painfully exercised in contemplating the infatuated victims to the frauds of artifice or the mistakes of benevolence.

Having thus considered the errors of quackery, and endeavoured to prove the absurdity of placing experience in opposition to reason, I shall now go on to make one or two further observations on the deficiencies and redundancies of the medical art, in relation to those other modes of deducing inferences which I have attempted above to describe; and the order of our subject leads me first to mark more definitively the boundaries which divide the systems of empiricism and hypothesis.

As an empirical inference which truth does not own is, if I may so express it, passively defective from defective information, so the other has more the character of suppositious or inventive error—it is in a degree the difference between folly aud insanity; between the conceptions of an ideot and the conceptions of a maniac. To illustrate. It has before been said that to attach an universally anodyne power to opium, inasmuch as it has been found to relieve pain in one or two instances, is an empirical incomformity to truth; the systematic, aware of this, endeavours to bring all his observation to bear upon the subject; he finds that violent pain is compatible with and apparently consequent upon two conditions of the animal frame, which are directly opposed to each other. When this expression of disorder is combined with a full and vigorous state of the system, he has experienced often that the agent in question tends rather to augment than to allay that perturbation and its consequences, to diminish which it was employed. From these facts he shall perhaps draw the inference, that opium relieves pain by virtue only of its stimulating or exciting property; from which inference he shall deduce another and more comprehensive doctrine, viz. that all those substances or powers, which acting upon the animal system, in seemingly different ways, have acquired, from partially and incorrectly viewing the subject, actually different denominations, are susceptible of one broad principle of explanation, namely, that of urging the vital powers into increased action.

Were this conclusion correct, no one could doubt its incalculable importance both in reference to physiology and practice: but it is the duty of an individual engaged in the pursuit of truth, to try the doctrine by the touchstone of further observance, and, without prejudice or partiality, to modify the axiom according to the information of his researches.

Now the author of the doctrine just noticed has been fully justified, even by the severest laws of philosophizing, in its conception and even enunciation; but the danger, in the present instance, consists in such author being more anxious by his future researches to establish the validity of his system, than to enquire after truth. He conceives a parental partiality to his principles as his offspring, and should facts even force themselves upon his notice, which might have a tendency to create a suspicion of their legitimacy, he voluntarily shuts his eyes against such evidence, and perseveres in owning, maintaining, and defending them.

Here, then, we find the routiner and the man of system in some measure to join issue—the one being misled by precedence and experience, the other by dogma and doctrine. But still let us not hesitate to give the decided preference to that which may be named the more philosophic error. In the first place, by boldly stepping forward into the field of generalization, our systematic has advanced positions, which if not true have at least a tincture of truth, or at the worst, has thrown out to his unbiassed and unprejudiced cotemporaries or successors, materials upon which their judgment can be exercised and their minds instructed. That this has been most conspicuously the case in respect to a late medical reformer of much celebrity, we shall, I think, perceive in the prosecution of our researches.

And, further, with regard to the influence which even a bigotted attachment to system is calculated to possess over the minds of individuals, we shall find it to be less injurious in a practical point of view than might be imagined. While the empirical nurse contumaciously adheres to the practice of torturing your infant by the fillets, rollers, bandages, and other cruel implements of the nursery, because, and only because her predecessors in the art and mystery of nursing have done so before her, while the gossiping and the empirical pour down their draughts for no weightier reason than that the same medicines have been administered to others in similar situations; the systematic, I am persuaded, however painful it might prove to act contrary to his preconceptions, would pay the first attention to the bedside call of nature, reason, and true experience; and even while combating disease under the banners of Brunonianism, would forsake his cause rather than his patient *.

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* I can recollect, when fresh from the university, and young in the practice of medicine, it was with painful feeling that I often found myself incapable of reconciling the dictates of experience with the doctrines of Brown; and in this juvenile partiality to system I conceive myself not to have

On the two other sources of error in medical reasoning, I will endeavour to be brief, because these last are less immediately operative upon the practice, and have rather reference to the general body of physiological and pathological doctrines.

I have already sufficiently explained what I mean by metaphysical error, and in the words of an author deserving still more celebrity than he has obtained, stated, that it has its origin in the groundless belief of mankind that we are acquainted with the nature of causation: it is this belief, with the suggestions to which it has given birth, that has bewildered the ingenious, terrified the timid, confirmed the sceptical in his doubts, and which has blended science and truth with poetry and fiction; a belief which has happily lost ground under the good sense and well regulated rationality of the present times, as the clouds of the morning are dissipated by the noonday sun.

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been singular. But it surely does not suppose any particular share of sensibility to deem the fate of our patients of superior consequence to the fate of our theories.

I recollect an illustration of the tendency that this mode of philosophizing has to bias the understanding and blind the perceptions, which is well given by Dr. Beddoes in his masterly edition of the *Elementa Medicinæ* of Brown; and which I recollect to have heard referred to by my friend Dr. Reid in his lectures. "In treating of that obscure subject," says Dr. B. "the coagulation of the blood, Mr. Hunter observes 'that it some- 'times takes place very quickly, as in mortifi- 'cation; but then it is to answer some good 'purpose, and arises from *necessity, which appears* '*to act as a stimulus in disposing the blood to* '*coagulate.*' It may be laid down as a rule in logic," continues Dr. B. "that general terms ought never to be employed, unless we can substitute particular terms expressive of appearances in their place. Mr. Hunter confesses his ignorance of those changes which he comprehends under the phrase—stimulus of necessity. It is manifest therefore that it refers to nothing cognizable by sense; and his position amounts simply to this, *the blood coagulates because it must coagulate.*"

In like manner the ἐνορμῖον of Hippocrates, the Natura of Galen, the rational soul of Stahl, the Archœus of Helmont, and the vis naturæ medicatrix of others, have proved so many ignes fatuii to mislead and betray theorists into the quagmires of false philosophy; for, when nominal are substituted for real essences, they leave us in the same state of ignorance as before we commenced our researches, and are objectionable, inasmuch as they serve to cherish the belief that we are advancing in science, when in truth, if not going retrogade, we are at least in pursuit of something that still remains and ever will continue at the same distance. We try to gain the horizon; we attempt to grasp the rainbow; and are thus diverted from the interesting objects which are profusely scattered in our path, and which we might have noticed and profited by, in passing over this ground, had not our views been mainly directed to one unattainable object. We forego the substance of real knowledge to embrace the shadow of false theory.

Lastly, of physical errors in philosophizing, or the improper application of the laws and language of one science to the explication of another, at the expence of observation, of reason, and of truth.

The tutor of Pickle was scarcely more at fault in demonstrating by diagrams his pupils' deviation from the right line of conduct, than some pathologists have been by their perversion of philosophy in the manner now referred to. "Investigations relative to medicine" (I find it observed in the same page to which I had turned for the extract from Mr. Hunter) "have been carried on just as rationally, as if to discover the qualities of the horse, the naturalist were to direct his attention to the movement of a windmill." The reader need only to revert to the very slight sketch of medical history contained in the preceding chapter, and he will readily subscribe to the above remark. The human body has now been converted into a chemical alembic, now into a hydraulic machine, its functions have been explained at one time by numbers, at another by forms, and at another by figures; and such conceptions, and such expositions, have often proved quite as much at variance with reason, as the practice of the poor peasants in Cornwall, who we are told, calculating upon the explosive power of gunpowder, swallow it, after receiving the infection of small pox, in order to make the eruptions appear; as the man of whom Boerhaave speaks, who to qualify himself for a running footman, dieted himself with hares; or as the prescriber of greyhound broth for a surfeit, occasioned by hare soup.

But, it is easier to ridicule than to remedy—to trace the track of error, than describe the line of truth; and the reader has a right to enquire the grounds upon which the medical philosophers of modern times argue their comparative freedom from the faults of their forefathers.

I answer for them briefly, that they are careful to analyze and compound the elements of their knowledge; that they are industrious to separate that which is conceived, from that which is deduced; that they remain content with ultimate facts, in place of restlessly seeking for final causes; and lastly, that in the true spirit of eclectic philosophy, they seek for truth beyond the sphere of authority, and follow science untrammelled by sect.

Whether these positions are substantiated, and how many are the exceptions to their full admission, it will be for the reader to determine when he has gone over the remaining pages of the present treatise. I shall now proceed to offer a few remarks on that system of medicine, which with all its faults, and many it contains, has in my mind considerably co-operated, with the tendency of the times, to introduce into medicine this spirit of independent inquiry and correct reasoning.

CHAPTER IV.

"MORE than twenty years" says Dr. Brown in his preface to the Elementa Medicinæ, "have been employed by the writer of this work in learning, teaching, and scrutinizing with diligence every part of medicine. During the first five of this period, he gave implicit belief to the doctrines in which he was educated, and regarded them as acquisitions of value. His employment the next five years was to explain and polish the several particulars. In the five following, nothing having proved satisfactory, he began in common with many eminent men, and even with the vulgar, to deplore the healing art as made up of uncertain and incomprehensible principles. The whole of this time then, which might have been engaged in valuable pursuits, was consumed in unavailing inquiry; and, it was not until between the fifteenth and twentieth year, that the light of truth broke upon his mind, like the dawn of day upon a wandering and benighted traveller*."

He proceeds to inform us of the manner in which he was first induced to suspect the authority, and finally led to detect the errors of the schools; after which we have a statement of his own opinions respecting the functions and susceptibilities of animated nature. He assumes the existence of a principle inherent in the living fibre, through the medium of which every agent influencing the system invariably acts—

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* "Ab hujus operis scriptore viginti amplius anni, discendo, docendo, nullas medicinæ partes non diligenter scrutando consumpti. Quorum annorum, quinque primi, aliunde accipiendo, accepta cognoscendo, credendo, quasi pretiosam possessionam occupando: proximum lustrum, singula clarius explanando, subtilius excolendo, poliendo; tertium dubitando, quia nihil ad mentem processerat, algendo, cum multis claris viris, cum ipso vulgo, pro incerta penitus, et incomprehensibili salutiferam artem deplorando; sine fructu, sine dulcissima rerum menti, luce veri, præteriere, tanta caduci et brevis ævi mortalis pars, tam opima periit. Solo quarto lustro, veluti viatori, ignota regione, perditis viæ vestigiis, in umbra noctis erranti, perobscura quædam, quasi prima diurna, lux demum adfulsit." Brunonis Elementa Medicinæ. Præfatio.

whether this agency be external or internal, physical or mental, medicinal or dietetic; none of which, according to our author, are capable of effecting a direct and essential change of any kind on the living principle, their primary operation being without exception, that merely of exciting the animated fibre into *action*—" an action produced upon principles entirely different from the impulse of mechanism, or the attractions of inanimate matter"—" that the deviations from the healthy state is not either repletion or inanition, or changes in the qualities of the fluids, whether of an acid or an alkaline nature, or the introduction of foreign matters into the system, or a change of figure in the extreme particles, or a disproportion in the distribution of the blood, or an increase or decrease of the powers of the heart as regulating the circulation, or a rational principle governing the actions of the body, or an alteration of the extreme particles as being of too large or too small a size, or an alteration in the pores as being too narrow or too capacious, or a constriction of the superficial vessels from cold, or a spasm of these vessels producing a reaction, as it has been called, of the heart and arteries, or any thing that has yet been thought of respecting the cause and nature of the morbid state. On the contrary, health and disease are the same state, depending on the same cause, that is *excitement*, varying only in degree, and that the powers producing both are the same, sometimes acting with a proper degree of force, at other times either with too much or too little; that the whole and sole province of the physician is not to look for morbid states and remedies which have no existence, but to consider the deviation of excitement from the healthy standard, in order to remove it by proper means."

Now could this position be substantiated, or proved, that from the variation of excitement (incitatio) alone the origin of every malady may be traced and its treatment regulated, this excitement itself knowing no difference but in degree; there would remain no doubt that all the doctrines and theories which had been conceived and promulgated by the predecessors of Brown, from the commencement of medicine downwards, must at once tumble to the ground; and no man, with sense to discern or discrimination to judge, would hesitate to give an affirmative reply to the following confident demand of our reformer in reference to his own principles. "Whether the medical art hitherto conjectural, uncertain, and in the great body of its doctrines false, is not at length reduced to a science of demonstration, which may be denominated the science of life?" *

But unfortunately for medicine and mankind, the simplification which Brown demanded from nature, nature refused to supply; and I am sorry to add that throughout the Elementa Medicinæ we find almost every where a determined spirit on the part of the author, not merely to make facts bend to system, but to deny or question facts, irreconcilable with his

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* See the English edition of Brown's Elements of Medicine, edited by Dr. Beddoes, or that more recently published by Dr. Brown's son, William Cullen Brown, M.D.

system, in themselves established and unquestionable.

In remarking on Brown's doctrines, it may be observed in the first place, that should we concede to his position that fibrous excitement is a necessary and universal preliminary to every other change operated upon the living body, such concession could not be made without the qualification of difference in the *kind*, as well as in the degree of action or excitement thus produced. Who but a determined systematic would contend for the identity of agency in opium and vitriolic æther. Both the one and the other stimulate or excite; granted, but do we find no variation in the mode in which their exciting powers are developed? In fact, the ad absurdum extreme of inference from Brown's fundamental datum would be the reduction of all medicines into one; for were there no difference but in energy between opium and æther (to go on with our examples) the one by an increase or decrease of dose might unquestionably be employed to the total exclusion of the other.

A second error, which our author's generalizing disposition led him to embrace, respects the universality of excitability, or the equal distribution of this principle, throughout the living sytem, for it is a fact that one organ can be excited while another is depressed, and that too by the same means; thus we find it admitted by those even who are reluctant to question the authority of Brown, that foxglove, while it reduces the actions and power of the arterial, excites and invigorates the absorbent vessels.

Thirdly, our theorist, in denying the direct agency of external powers upon the fluids, and, but through the intervention of excitability, the solids of the system, was either ignorant of, or overlooked several facts in the œconomy of animated nature, to which we shall afterwards refer. It will be seen that some substances, which may not have any sensible or immediate agency upon the excitability, shall become by a species of chemical attraction, component parts of the living frame; this, however, by no means in that mode nor to that extent which was formerly imagined, and is by some speculatists at present conceived.

Such then are the leading errors of Brown's principles—that they admit no variation but in the *degree* of excitement; that they deny the irregular distribution of susceptibility to excitation; and that they exclude the operation of powers upon living matter, the agency of which is in no measure reducible to the quantity, nor even to the kind of excitation which they occasion—errors which do not so much follow from the principles themselves, as from their unwarrantable extension, so that by a due qualification, they may not merely be made to square with truth, but can, I think, be proved to have effected a considerable and an important revolution both in medical theory and practice.

For, by aiming to prove an identity, Dr. Brown has most indubitably established a similarity of agency in several restorative powers, which had previously been regarded as fundamentally different, and the promulgation of his principles has thus served to diminish the superfluous number, and lessen the absurd complication, of medical recipes.

Secondly, by refusing to regard the living body as a mere system of vessels and instruments, subject to obstructions and impediments in the same manner as a machine unendowed with vitality, the doctrine of excitement has checked that rage for inordinate depletion which had arisen out of some of the hypotheses which have been referred to in the preceding chapter.

In the third place, Brown has evidently simplified and improved the theory and practice of our art, by subordinating several symptoms of disease into their proper rank of effects, which had before been considered in the class of causes.

And lastly, it may be observed that the theoretical misconceptions and practical mistakes of some of our author's predecessors, respecting impurities in the blood and the humours of the body, which, originating in medical schools, had descended among the vulgar, have been confuted and exposed by him and his disciples with success and advantage both to the profession and the public.

In endeavouring to illustrate and confirm the validity of the preceding observations, it may not be improper further to follow out the theory of Brown in its application to a few of our most common and formidable maladies, and from these we shall select one or two of those, the treatment of which the system now under review boasts of having essentially altered and materially improved.

First of Apoplexy. That suspension or interruption of the animal functions, which constitutes a greater or minor degree of an apoplectic paroxysm, had so long been attributed to pressure on the brain, either from an inordinate distension of its vessels, from too rapid a circulation through these vessels, or from their rupture and consequent effusion of blood upon the brain;

and the notion had been so long prevalent that depletion in these cases was imperiously called for and absolutely necessary to recovery, that it supposed no inconsiderable share of independent judgment to question a conclusion which had such prescriptive authority in its favour. Dr. Brown, however, fearlessly advanced into the field of controversy, and roundly challenged the legitimacy of the inference upon which the practice referred to had been grounded. Apoplexy, in the system of Brown, is a consequence of debility, or, in his phraseology, deficient excitement: to remove this debility, to restore this excitement, are, he contends, the sole views which ought to regulate the treatment of the disorder in question; and on this ground he argues, not merely the inutility, but the positive danger, of evacuation, which cannot but tend to increase that weakness which it ought to be the physician's object to counteract.

Now, there cannot be a question that the majority of apoplectic attacks suppose this debility for which our author argues; it is equally certain that the leading principle in practice is to obviate this impeded or diminished energy; it is still further granted that, as well in reference to the particular complaint under notice, as to many others, a neglect of preserving this prime object in sight has occasioned much and serious error. But the voice of general laws must not deafen us to the urgent and immediate demands of particular circumstances; and, indeed, such particulars, when regarded in a proper light, do by no means interfere with primary or fundamental principles.

I am called to the bedside of a patient, whose animation is suspended in consequence of blood flowing with more velocity or in greater quantity through the vessels of the head than is consistent with the maintenance of the healthy state; this deranged condition of the circulation has probably been induced by an insufficient energy in the living power, or by defective excitement: allowing this to be the case, and conceding at the same time to the position that evacuations of blood tend to debilitate, the urgency of the circumstances demand me to have recourse to this, the only means perhaps of preserving the vital principle from entire extinction. To set about stimulating the system, while in the state we are now supposing, would be like throwing impediments to the landing of an army, when the army stood marshalled on our shores.

It is scarcely necessary to apprise the reader that in these few suggestions on the tendency and influence of Brunonian principles upon actual practice, I am not about to enter minutely into the several affections that are adduced by way of example. Properly to discuss all the requisitions of the disorder now under consideration, its various states, its different degrees, its almost innumerable modifications, when depletion is demanded or forbidden, of what nature the evacuations ought to be, and to what extent, were to engage in a much wider field of investigation than would be consistent with the limits I have prescribed to myself; otherwise I might go on to observe, that in many instances, even of apoplexy, blood letting may well be superseded by the employment of other means which, with less danger to the constitution, are equally efficacious on the complaint.

I shall conclude this part of the subject by expressing my belief that the speculations of Brown have, in relation to disorders of the nervous class, from the mere numbness in the fingers up to the full formed apoplexy, " motus voluntarii fere omnes imminuti, cum sopore," proved of incalculable utility in checking both that professional and vulgar rage for indiscriminate reduction, which had so long been prevalent; and, though by no means a follower of this speculatist to the extent of his book reasoning, though I do not nor can subscribe to the position of one of his disciples, that " to take blood in apoplexy is always of dubious propriety," I do think it of most essential moment to pay primary regard to the requisitions of the nervous system—to recollect that the altered circulation is for the most part an effect, not a first cause of the derangement in the nervous excitability—

that in many instances this can only be remedied by the due and discriminate use of agents acting upon this system—and that blood-letting, though often, very often, absolutely necessary, is for the most part to be resorted to as a necessary evil.

If it be urged that good sense and unassisted rationality would have taught us all this, I answer that many truths, both of a speculative and practical nature, which now, from their apparent simplicity, would scarcely seem the results of science, required the application of science to render them thus obvious; and we may remark that theorists have this disadvantage to contend with; that, while the benefits they confer upon society, are often not appretiated, because not observed, inasmuch as their discoveries gradually amalgamate and become as it were *parcel of knowledge*, their errors in the mean time separating themselves from this mass, as dross from gold, are readily delivered over to their original proprietors.

But to proceed in our investigation. The endemic of the British islands is that complaint and its consequences, which, without being easily described, is in this country familiarly known under the appellation of *a cold;* a term, which, applied to the symptoms it is intended to include, involves the theory of their origin; or at least, in place of the effect by which maladies are for the most part designated, substitutes, by a kind of metonymy, the cause.

Some of my readers will be no less surprised to learn that cold has been denied to occasion that disorder which they have been accustomed to call a cold, than that blood-letting has been proscribed in apoplexy. In cold, however, or as we technically, but by no means properly, call it a *catarrh*, Dr. Brown proposed as entire an alteration, both in regard to the theory of its origin, and the plan of its treatment, as in the disease we have just been considering.

The general notion we believe of those who are accustomed to reason at all on the nature and cause of the irritation now referred to, is, that in consequence of exposure to cold, the pores of the surface cease to perform their accustomed and salutary exercise, the perspiration is thus obstructed, and that fluid, which formerly made its way, either insensibly or in perceptible quantity through this outlet, collects about the head, the nostrils, and the lungs, and is discharged from these organs with that disturbance both of the organs particularly affected and of the whole frame, which is consequent upon this deranged balance in the relative action of excretory organs. Now I shall attempt briefly to describe the theory of Brown and his followers on this subject, and then as concisely as possible inquire into the validity of either doctrine.

Cold, say the advocates of the Brunonian hypothesis, is not an absolute but a relative thing—it is a mere negation of power—a subduction of the stimulus of heat; it does not directly act upon a living body, even when in excess, in any other way than by creating a more than common or salutary susceptibility to the agency of heat. Thus, if I immerge my hand in water, say at the temperature of 40°, that reduction of temperature shall be found to operate in exact proportion to the degree of previously existing heat; and further, when I take my hand out of this cold water, I shall find it affected by the circumambient heat in a way in which it had not been previous to the reduction of temperature; the hand will feel warm *because* it had been exposed to cold, and the warmth will be in the ratio of the cold.---In Brunonian language, excitability had been accumulated, and excitement more than ordinary follows.

In this negative manner then is cold supposed to operate towards a catarrh; it does not close the pores, it does not send the fluids from the surface to the lungs or nostrils, but merely creates an undue susceptibility of excitation from those powers, which, had cold not been unduly applied, would have temperately stimulated or orderly excited.

I scarcely need observe, that with the adoption of these different principles, the curative plan must be likewise materially different; for to sub-due a cold on one hypothesis, is to restore obstructed perspiration; to prevent it, is to guard against exposure to cold: to cure the disorder on the other theory, or even to prevent it, is merely to withdraw or regulate the exciting power of heat---plans diametrically opposite: so much so, that while physicians of one school pour in their heating fluids and sudorific medicines, for the purpose of opening the closed pores; those of the other, contend that this practice is both absurd and dangerous.

Here again, an unbiassed inquirer will find truth taking its stand at some point between the extremes of opposite opinion. In favour of those who advocate the most generally received doctrine respecting the production of catarrh, it must be admitted that the various excretories of the body have a relative connection, if, for example, the outer skin be less than usually excited by heat; in other words, if the surface of the body be exposed to cold, the action of its vessels is in some measure suspended, and other organs are called upon to supply this deficiency;

thus we find more secretion from the kidneys in cold than in warm weather.

In the instance, however, just cited, the altered proportion of excretion is not accompanied by any irritation of the whole system, as in the case of catarrh: this circumstance then forms an objection to the mode of explanation adopted by the old theorists respecting the production of catarrh, for why should not the diversion of the fluids to the urinary, be accompanied with the same feelings of languor and irritation as to the pulmonary organs*?

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* The particular tendency of the membrane lining the nostrils and lungs, to be affected in cold, and to bring with it the feelings referred to, is in truth inexplicable on either theory: we only know it as fact that currents of air blowing upon one *part* of the body, or partial applications of cold in any form, are more apt to induce catarrh; while, when the whole body is at once subjected to a reduction of temperature, the effect is often merely that above related.

The only plausible explanation that has been attempted of the overproportionate number of catarrhal complaints in Britain is, that the inhabitants of this country are too apprehensive of *general,* and too fearless of *partial* exposure to varieties of temperature.

But further, it is urged by the apologists of Brown, that "this supposed vicarious discharge does not invariably occur. Every symptom of a cold shall be frequently present, without this peculiar affection of the mucous membrane in any part of its surface; and, in other instances, from direct irritation induced in this vascular and very excitable part; *the catarrhal discharge shall be occasioned independently of any diminution* in the quantity of cutaneous or other excretions. This latter circumstance is particularly deserving of remark. It entirely overthrows the doctrine of mechanical derivation. By an increased *action* in a particular organ, an augmented secretion of such organ is proved to be generated without the smallest subduction of any other fluid to afford its supply. Certain irritating substances introduced into the nostrils shall, under circumstances of peculiar irritability in their investing membrane, be productive of a genuine catarrh, or, at least, of what has been regarded as the prime and essential symptom of a *cold*, and as the necessary consequence of obstructed perspiration, without either the previous application of cold, or the smallest interruption in the cutaneous discharge *."

Obstructed perspiration then being almost demonstrated an insufficient cause for the production of a catarrh, we were left at liberty to search for another; and a satisfactory one was said by the Brunonians to be found in the application of the law above alluded to. But Dr. Brown, in adapting his principles to the elucidation of this complaint, as well as others which he regarded as actually similar, though accidentally varied, in some measure negated his own assumptions.

"Frigus nunquam nocet, nisi ubi ejus actionem calor excipit." The application of cold to the living body never proves injurious, unless it be succeeded by heat; it is not therefore the mere exposure to cold which produces catarrh, but the subsequent exposure to heat; and, by

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* Dr. John Reid, on the Origin, Progress, and Prevention of Consumption.

avoiding this last, the disease may be obviated. It ought, however, to have been recollected, that the animal frame, by the exposure alluded to, is rendered susceptible, not merely to the subsequent action of *exterior*, but also to that *interior heat* which, previously existing in due proportion to the demands of the system, now acts relatively so as to occasion similar effects with an absolute augmentation of force or stimulus; and the functions are by consequence thrown into disorder.

Both experience then, and even the principles of Brown, when properly qualified, are at variance with the practical position he deduced from his own discoveries, and which, as it appears to me, some of his disciples have aimed to support in face of opposing fact; namely, that an individual may fearlessly expose himself to cold and damp in any shape, provided he be careful to shun the precipitate application of subsequent heat, or avoid recourse to those stimuli which on the other theory have been taken in order to prevent a cold.

That the inference I refer to is uncountenanced by principle has, I think, already been sufficiently shewn; and, that it is unjustified by observation, we have hosts of witnesses to bear testimony, who have had febrile irritation, dryness in the nostrils, and other catarrhal symptoms engendered, even while still exposed to wet and cold; nay, sometimes simply setting the feet on a stone floor, or cold floor cloth, shall be productive of an immediate, a genuine, a severe, and a lasting catarrh.

Still there can be no doubt, I think, by a person who takes an impartial survey of the subject, that the hypothesis of our author, thus theoretically and practically modified, has proved essentially serviceable, both in the medicinal and dietetic management of the malady under notice.

The injudicious pursuit of that practice which had been derived from the source of a supposed necessity to restore obstructed perspiration, has, I verily believe, produced much and serious mischief. Let us suppose, for the sake of general illustration, two subjects with an equal degree of catarrh, but with widely different constitutions; the one, with a hardy fibre, shall have hale and capacious lungs; the other, joined to a debile frame, a peculiar, a consumptive irritability of the pulmonary organs. Now by " feeding," and stimulating, and heating the catarrh of our hardy patient, we shall perhaps more speedily, as effectually, and with equal safety expel the enemy, as by the more moderate and seemingly more philosophic plan of Brunonian management; namely, by keeping the body cool, by preserving against precipitate and partial exposures to currents of air, by forbidding heating and irritating diet, or in the words of an author quoted above, by " letting excitement be exhausted by its own action." In the second example, we shall find this last the only justifiable and safe system to pursue, otherwise by curing cold we shall chance to give consumption, by restoring the functions of the skin we shall encounter the risk of irreparably injuring those of the lungs.

A catarrh is very often the precursor of Consumption; and too frequently this supervention of the latter upon the former results from an improper manner of treating the original disorder. On this important subject likewise, a subject as momentous as any that can summon the attention of the British physician, Brown and his followers have considerably dissented from the principles of the preceding schools. Our theorist assumes debility as the essence of the disease, and the local affection of the lungs, which is "so much the object both of the faith and fear of physicians," he argues is of incidental occurrence and inferior import. Support the strength of the sufferer, and you cure the malady. This is still an instance of unallowed extension and indiscriminate application of principles in themselves valid. Crowds of consumptive patients have undoubtedly been lost from an inattention on the part of the prescriber to the prevailing weakness as well as local affection; but on the other hand no one, I can almost venture to say, who has professionally and without prejudice examined into the requisites of phthisical subjects, will deny that the utmost solicitude, care, and skill, in the administration of medicines and of food, in order to support the excitement and strength, are too frequently frustrated by the irritation which these occasion to the lungs. A secret enemy is sapping the foundation of the building, and till this enemy be dislodged, we lay on materials in vain. Nay, it is not seldom observed, that without much attendant weakness, the cruel malady in question proves fatal merely as a disorder of parts, "as a local disease it undermines the fabric of vitality, and breaks the slender thread by which existence is supported."

In regard to the theory and management of all those deviations from regular and healthy actions which are comprised under the head of spasmodic disorders, Brunonian simplification has in my mind been productive of abundant usefulness, and as far as the nature of medical evidence enables us to consider sequence in the light of consequence, I flatter myself that I have witnessed, both in the practice of myself and others, the most happy results from the distinction, which I really think our author had the merit of fully and explicitly establishing, between action and power. Before his time, indeed, we had been furnished with the medical axiom of much value, Debilitas gignit spasmum; yet, still we were in want of a bolder generalization of facts to guide us through the mazes of convulsive affections, and to discover the secret of antispasmodic agency. Even here, however, errors, both of omission and commission, are plainly perceptible.

I shall detain my reader no longer on this division of my subject, than just to make one or two observations on the advantages which have resulted from the speculations of Brown, as it refers to the treatment of infantile ailments.

It is not surely necessary to say that any system, which prefers the smallest claim to improvement in this department of medicine, challenges a full and fair investigation; and, without indulging in exaggerated statements of the artificial decrepitude and premature mortality of our offspring, from the meddling imbecility of soi-disant doctors, or the more positive and active cruelties of nursery lore, without regarding the druggist's shop as the readiest way to the sexton's repository, or the sound of the mortar, for the preparation of the infant's drug, as a sure anticipation of the funeral toll; in a word, without exciting the stare of some, and the indignation of others, by abuse, which really has been a little too lavishly dealt in, of nurses and gossips, and prescribers and dispensers of medicines, it may be allowed me to state that infancy and childhood demand from the professed guardians of the public health, an attention peculiarly assiduous and perfectly sincere, freed totally from all tendency towards accommodation to the fears or prejudices of parents. Either positive or negative insincerity, if I may use the terms, were here doubly criminal; for, "the physical temparament, as well as the moral character, retains through life the stamp of early impression." Neglects and errors respecting the requisites of infancy are altogether irremediable by subsequent management. "Frequent disturbance of functions in the dawn of life often overcasts its meridian and close with a cloud of misery, such as neither skill nor fortune can disperse," and in advanced life it would be poor consolation in answer to the almost spectral accusations of a sickly youth, rendered so by our insincere adaptation to fear and to folly, to be furnished with the sophistical plea of Macbeth to Banquo, "Thou canst not say I did it."

Thank heaven the necessity is daily declining of severe censure both in regard to medical and dietetical mismanagement of the infant œconomy, and, unless I am much mistaken, the reformation which has decidedly and recently obtained in the treatment of those for whose welfare we are doubly responsible, owes its rise in a very great measure, to the bold and generalizing good sense which the Brunonian tenets have brought into play.

On this head it will perhaps be better to defer further remarks till we come to make our proposed inquiry into the subject of popular medicine. I shall first endeavour to shew the advantages which have accrued to medicine from modern chemistry; as preliminary to this investigation it may be proper briefly to examine into the precise nature and objects of chemical science —an enquiry which shall be the subject of the succeeding chapter.

CHAPTER V.

CHEMISTRY has been defined by a modern writer on the subject, "that science which treats of those events or changes in natural bodies, which are not accompanied by sensible motions." Thus if I mix two fluids which are of a different nature, I shall obtain (without this mixture undergoing any perceptible change, otherwise than in the effect occasioned) a product which shall be as different from either of the two fluids which were the subject of my experiment, as the one of them had previously differed from the other—the first has formed this curious combination with the second, and together they have constituted a new body.

By pursuing our experiment still further, we shall find that the two substances upon which this change has been operated may, in many cases, be regenerated or made to reassume their original character. We will take the most familiar examples for the purpose of illustration.

The two ingredients which have formed this tertianary substance shall have been the one an alkali *, the other an acid †, from their admixture a neutral is produced; now let another kind of acid in due quantity be admitted to this mixture, and it will separate the union just made, the first acid shall reappear, and the neutral shall

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* The word alkali originated with the Arabians; To that white substance which remains after the incineration of a certain plant called *Kali*, the ashes being washed, this name was for a long time exclusively applied: it has however since been discovered that many other plants besides this kali, treated in the same manner, yield the same principle. The word alkali is now therefore extended to all bodies which have "1. a caustic taste; 2. are volatilized by heat; 3. are *capable of combining with acids, and of destroying their acidity*; 4. are soluble in water even when combined with carbonic acid; 5. are capable of converting vegetable blues to green."

† Acids are defined those substances which beside exciting the sensation of sourness, change blue colours of vegetables to red, unite with water in almost any proportion, and combine with alkalies, metallic oxyds, and earths, forming neutrals.

be different in quality, owing to the junction of the last acid with the remaining alkali.

Or, let another species of alkali be the substance superadded to either the first mixture or the second, and this alkali will rush into combination with the acid, and thus constitute a tertianary substance still different; the first alkali being separated in order to make room as it were for the last.

Without any precise notion of the mode in which these phenomena are engendered, or to use the words of our definition (which perhaps are not the most accurate that might have been selected), "these changes not being accompanied by sensible motions," chemists have referred the effect to a reciprocal action between the minute particles of bodies; which action, or rather the capacity of and tendency to it, they have properly enough designated by the word *affinity*:—thus in referring by way of explanation to the examples just quoted, we should say that the second acid, or the second alkali, which added to the neutral separated the first, had more affinity with the remaining alkali or acid than with that thus disunited.

Now the bare statement of the above familiar facts, in regard to chemical agency, were sufficient to shew the necessary and intimate connection of chemical with medical knowledge—in truth they are absolutely inseparable; and when we hear the necessity decried of chemistry to the physician, we have only to call to the objector's mind the number, the variety, and the complication of medicinal agents; which, employed without an acquaintance with their relative connections and combined powers, as well as their simple virtues, would frequently so interfere the one with the other, as entirely to defeat the purpose for which they had been employed.

Suppose for example, I meet with a malady for which I desire to administer two medicinal articles, the physical operation of which shall not be at variance, but whose chemical attraction or opposition shall be such as in one way or the other to produce a mutual destruction of their original principles. It scarcely need be observed, that by aiming to give both these medicines in composition, I shall not give either, unless with a knowledge of their affinities I so manage their admixture as to ensure against the combination or decomposition referred to. I wish that it were not in my power to add that the recipes of some physicians, even in the present day, at once evince the deficiency, and prove the expediency of that species of knowledge, for the necessity of which I am now contending.

But to return to our subject. Hitherto we have referred merely to change of quality as consequent upon chemical combination; it is however necessary to attend also to the change in form as well as in essence, or to that curious fact in the history of nature, that a body may assume, according to the different circumstances in which it is placed, an altered shape or varied bulk, while it continues virtually and essentially the same material. Accurate notions respecting this quality in matter were reserved to reward the labour and well directed ingenuity of modern times, and have totally overthrown the elementary division of bodies instituted by Aristotle, and for a long time prevalent into fire, air, earth, and water, which in fact are not distinct essences, but merely modifications of matter.

Take a certain quantity of ice, throw into it a given portion of heat *, and it becomes water; add more heat, and the water passes into that state which is called steam; let a further supply of heat be added, and the steam becomes vapour. This simple and well known fact may serve as an example of all the changes which are incessantly going on in nature's vast laboratory; which changes, as far as form and bulk are concerned, seem to depend upon the different capacities of bodies for, their reception of, and capability of

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* The reader will perceive in the sequel, that I use the word heat in a very different sense from that in which it is usually employed. In common language, indeed, the power producing the sensation of heat, and the sensation itself, are by no means distinguished. *Caloric* is the term which is chosen by chemists to designate the matter of heat, or at least the *cause* by which the phenomena of heat are occasioned.

being altered by, heat; and according to this susceptibility, are bodies permanently fixed or always naturally in a condition of solidity; permanently fluid, if not rendered solid by an artificial subduction of heat; or always in a state of vapour or air, unless subjected to the same process of forcibly extricating from them that quantity of heat which, in their gaseous or aereform mode of being, is invariably combined with them.

But the combination of heat with bodies is further subject to a law widely different from what we should at first sight conceive, and which, before we proceed, demands to be explained. The peculiarity to which I allude was discovered by the late eminent professor of chemistry in the university of Edinburgh; a discovery, which, with one shortly to be noticed, justly entitle their author to be regarded as the founder of that beautiful edifice, which has confessedly been fashioned and completed by the succeeding labours, principally, of the French philosophers.

Bodies are not rendered hot to the sensations, nay, do not exhibit to the thermometer a heat in the ratio of that quantity of caloric which they receive from without. Two masses of metal for instance, of different kinds but of the same weight, shall be subjected to a similar degree of heat, shall actually be made to extract from the surrounding media precisely the same quantity of caloric, shall, by consequence be, as it respects the matter of heat, in exactly identical circumstances, and yet neither to the feelings, nor even to the thermometer, shall indicate the same temperature; that body then which *seems* colder, though in truth holding an equal quantity of heat, is considered as having a superior capacity for caloric than the hotter material; and the heat which is thus imperceptible, but capable of being brought out from its hiding place, if we may so express it, was denominated by Dr. Black latent, it has since been called less emphatically, but perhaps more accurately, combined heat *.

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* Still more recently it has been called specific caloric.

We have hitherto supposed a difference in quality or essence in the materials operated upon; but the important law which I am attempting to explain, is also and especially influential in respect to the changes already spoken of, merely of form or bulk; for ice, water, and steam, in passing from one to another of their gradations, receive and give out heat in a proportion very different from the measure of caloric they would be conceived to contain, even by thermometrical test; and here we shall generally, not invariably, find, the degree of latent or combined heat according to the rarity of the substance.

Insert a thermometer into a given measure of boiling water, and the mercury in its tube will rise to 212°, convert the whole of this water into steam, and the indication will still be the same; now reduce this steam to water at the temperature of 60°, and collect the heat extricated in this reduction, and the steam will be found to have thrown out heat in much greater abundance than had the water been reduced to the degree of 60°, without the prior conversion of it into steam, because the water, with apparently the same heat, in fact contained a far less measure of caloric.

The above discovery then, we may perhaps be allowed to term the discovery of the latency of heat; the other to which I have alluded, is that of the fixidity, if it may be so expressed of air.

Every one is acquainted with the two states in which that species of earth is found which is called lime; it is generally known that lime simply, is mild and comparatively inert, and that when converted into what is denominated quicklime, it is a penetrating and corrosive substance. The manner in which this alteration is effected, had been as fact for a long time familiar, but the principle upon which the change is produced was altogether unknown until detected by the sagacity of Dr. Black. By a course of experiments, he ascertained and demonstrated that the causticity of quicklime is occasioned by the loss of a certain portion of a particular *air*, and that when again reduced to the state in which the earth is usually found in nature, this reduction is accomplished by the absorption from the atmosphere of this air, or rather its radical, which thus while existing per se, or as one of the constituents of the atmosphere, is in an aereform condition, that is, united with a large portion of latent caloric, and, when combined with the lime, becomes in a manner fixed. On this account Dr. Black, himself unacquained with the secrets of aereal phenomena that have since been developed, and not aware that other kinds of aereform fluids are capable of this fixation, denominated the substance in question fixed or fixable air;—it has since gained the appellation of carbonic acid gas.

The reader perhaps will be better able to understand and appretiate this important discovery of aereal absorption and fixation by a further illustration. Take a quantity of lime water, recently prepared and clear, inclose it in a given portion of air, that is, let the vessel which contains the lime water be surrounded by another which contains the common air of the atmosphere, so as that there shall be no communication with the surrounding atmospheric air; now after the lime water has stood some time thus open to a given measure of air, it will lose its transparency, become white and turbid, and (this is the particular fact to which the reader's attention is especially solicited) *the air of the outer vessel, if collected and weighed, will be found to have lost in weight a quantity exactly equal to that which the lime water has gained;* while the fluid with turbidness has acquired mildness—has become an essentially different substance, a change of quality has been operated upon the air employed in the experiment, inasmuch as it has been deprived of one of its ingredients.

I have thus aimed at giving an explanation of the great discoveries of Dr. Black, the value of which can scarcely be enough appretiated: the detection indeed of those principles which regulate the combinations of heat, has done for chemical nearly as much as the discovery of gravitation for mechanical philosophy; and, when we of Britain find ourselves inclined towards the indulgence of national exultation on the score of our great men, the name of Black ought never to be forgotten.

But it is now time to turn our attention to what has been justly called the French chemistry, for it was in France that the important revolution in the science, which has recently taken place, was fully accomplished.

One of the divisions of matter that has obtained among chemists, is into bodies combustible and incombustible. By the first of these terms they mean to designate any species of matter that, subjected to a certain degree and kind of heat, shall, by this exposure, be so altered in its texture and quality, as actually to become and permanently remain a new substance; while incombustible bodies are those which, by the same process, shall merely for a time be changed, and that only in respect to temperature.

You cannot, for instance, set a stone *on fire*, to use the vulgar phraseology, for whatever degree of heat you throw into it, it does not emit flame, and when you cease to supply it with caloric, it soon returns to its pristine state of temperature, having undergone no essential or lasting change.

With a piece of metal, however, the case would be different; you may actually inflame this substance; indeed you cannot expose it in the air to a certain degree of heat, without producing this inflammation; and now, the process being completed, you will find the material thus treated to be a something very different from that species of matter with which the experiment had been commenced; it has undergone a change as complete as that of quicklime into common lime, or as caustic into mild alkali.

Now what is the cause of this change? The notions which have been entertained on this subject may be ascertained by reverting to our own unassisted conceptions, or to the language still employed in order to express the effect. The antient philosophers conceived—a notion that is to this day general—the existence of a certain elementary something called *fire*, which was supposed to have the faculty of consuming, and as it were converting into itself, the bodies which it had the capacity of influencing—namely, those that we now call combustible bodies, while the residual substance, after the completion of the process, was imagined to be that part of the material over which this fire had no power.

The above, with the exception shortly to be noticed, continued to be the prevailing but gratuitous mode of explaining the phenomenon of combustion in all its degrees and forms, until Stahl proposed a new theory on the subject. This last author conjectured the difference between combustible and incombustible substances to consist in the former containing a certain body which he denominated *phlogiston*. When then a substance is burnt, or deflagrated, or calcined, which are so many modes of combustion, the effect is produced by the separation of this phlogiston, which now having parted from the material with which previously it had been combined, leaves the residue in a state of incombustibility.

This, the phlogistic theory of chemistry, variously modified by Macquer, Black, Crawford, Priestly, Kirwan, and others, long held possession of the minds of philosophers, and continued to be a doctrine universally in vogue, until the time of the illustrious but ill-fated Lavoisier, whose "noble discovery on the subject of combustion, the fruit of genius, industry, and penetration, has reflected new light on every branch of chemistry, has connected and explained a vast number of facts formerly insulated and inexplicable, and has new modelled the whole, and moulded it into the form of a science." *

The discovery referred to is this, that in every case of combustion carried on in the open air, a part of such air leaving its aereform state, combines with and actually becomes a constituent of the burnt body in the same manner that the fixed

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* Thomson's Chemistry, 3d edit. vol. 1. p. 572.

air of Dr. Black forms an ingredient of mild alkali or common lime: and that, contrary to the opinion of the phlogistic chemists, who inferred or supposed the *loss* of something (phlogiston) during the process, the change operated on a body by combustion is solely referable to this *acquisition* of a fresh principle.

It was not until the result of Dr. Black's investigations, and more especially the succeeding inquiries of Dr. Priestly, had summoned the attention of the philosophical world to the nature and qualities of elastic fluids, that cognizance was taken of the change produced in the *air* employed in combustion, as well as on the material itself which is burnt. We find indeed obscure hints of this kind in the writings of Hooke and of Mayow, two philosophers of the seventeenth century, but which, although highly ingenious, as far as they go, have in my judgment no more claim to the anticipation of the Lavoisierean chemistry, than have the intimations contained in the writings of Servitus to the discovery of the blood's circulation.

It remains for me now to explain, in as brief and familiar a manner as possible, the antiphlogistic theory, and to contrast with the phlogistic hypothesis the luminous doctrine of the celebrated Lavoisier.

Let a piece of crude metal, say of quicksilver, be subjected to a certain heat, while exposed to a given quantity of air, this heat shall occasion that change in the metal which is called by chemists calcination. Now calcined mercury is as different from quicksilver in its crude state, both as it regards form and quality, as one metal is different from another, and it is no longer capable of undergoing the same process; if further we examine the air which has been inclosed over the mercury, we shall find likewise that an essential alteration has here taken place; it is no longer capable of contributing to combustion or of supporting life, it being deprived of its pure and respirable part. Dr. Priestly, and other of the phlogistic chemists, referred this mutual change, as I have above hinted, to the dephlogistication of the metal, and consequent phlogistication of the air; but, besides that this phlogiston is an imaginary undemonstrated something, the fact of the air being rendered actually lighter, and the calcined metal exactly in the same proportion heavier, runs directly counter to the supposition of the latter having lost and the former having acquired a substance or principle. When indeed this objection was urged against the phlogistic theorists, they had recourse to the sophistical subterfuge of the buoyant power of phlogiston, the loss of which seemed therefore to render bodies positively, although in fact, but comparatively or relatively heavier.

But Lavoisier entirely superseded the necessity of this evasion, by ascertaining that the oxygenous or pure part of the air is forcibly withdrawn from the air, and is consolidated with and become a part of the calcined or burnt metal; that hence this material is heavier than in its metallic state, and that hence the air is rendered lighter and impure: and he proved this not merely by analysis, but by synthesis; for, by other processes too numerous and complicated to detail, he restored the metal to its natural state, and in so doing, he made it give out exactly the same quantity of oxygen which it had subtracted from the atmoshpere, and this air by consequence regained its original degree of purity.

A body then which is combustible, or capable of being essentially and permanently altered by an increase of heat in the open air, differs from an incombustible substance in this, that, at a certain temparature, it displays an affinity to the pure part of the atmosphere, draws this principle from the other ingredient with which it had been combined, and, in the combination, as it now becomes part of a solid mass, gives out its latent heat *.

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* For the purpose of illustrating the combination of oxygen with combustibles, I have preferred the process of calcination before that of combustion, more strictly speaking, because this last is comparatively complicated from the following circumstance, namely, that bodies which are the subjects of it, consisting in a large measure of carbon, the oxygen that is extracted from the air united with this material, forms not a solid mass, but another kind of gas (carbonic acid gas), which, although specifically

I wish it were possible, consistent with the limits that I have prescribed to myself in the present little work, to make the reader duly sensible of the important consequences that have resulted from the discovery of this fact, that "in every case of combustion oxygen unites with the burning body," not that I would for a moment maintain that all the phenomena of chemical union have received that facile and unobjectionable explanation upon the new theory, which its inventors and promulgors at first sight conceived; but thus much is certain, that since the development of the above law, chemistry, from a science of but too frequently insulated particulars, has become a connected, general, distinct, and most interesting branch of enquiry.

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heavier than atmospheric air or oxygen gas, is still a gaseous substance.

One of the most important functions of the animal œconomy, and which, with regard to its nature, has had more light thrown on it than any other, by the recent discoveries of the chemists, the reader will afterwards have occasion to observe, has more resemblance to combustion than calcination.

By the researches indeed of modern philosophers, more especially of those we have had occasion already to name, Black, Priestly, and Lavoisier, it is rendered evident that all the succession and variety of changes which are incessantly operated by nature and art, in the material world, are scarcely any thing more than "a fixation or generation of elastic fluids," and that the most subtle air is in fact as much a substance as the hardest stone, with perhaps this difference only, that the principles of which it is constituted, having a greater capacity for, in a manner expand themselves wider for the reception of, caloric, and become so rare as to elude the ken of our senses: thus, although a real body, air is invisible and intactible.

I shall conclude this chapter by describing the constituent principles of that substance by which we are constantly, and, while we have life and breath, necessarily surrounded—I mean the air of the atmosphere, which consists of two radical or essential principles, namely, Oxygen[*], which, united with its aereal dose of latent heat, was the dephlogisticated gas of Dr. Priestly; secondly Azote, which, in the same gaseous state, is the foul air of Scheele, the phlogisticated air of Priestly.

To enumerate the various qualities, simple and combined, that are already known, of these principles, of oxygen especially, were to engage in an almost endless task; suffice it to say, that the oxygenous is the respirable ingredient of the air. An animal made to breathe this gas pure and uncombined, becomes alert and lively beyond measure, often even to a dangerous degree of excitement[†], "a taper burns in it with dazzling splendor; and charcoal (to which may be added several other combustible bodies) instead of consuming quietly as it does in common air, burns with a flame attended with a decrepitating noise, like phosphorus, and throws out such a brilliant light that the eyes can hardly endure it." *

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[*] The meaning of the word *Oxygen*, is that which generates or produces acids;—now it has been nearly demonstrated, that all acids are constituted by a mixture of the principle in question with the peculiar base by which they are distinguished;—hence the French chemists denominated it the oxygenous principle.

[†] Hence it has been named *vital air*.

Azote, the residuary principle after the oxygen has been extracted, displays effects exactly the reverse; neither animation nor combustion is capable of being maintained by azotic gas; if indeed an animal be exposed to air after the oxygenous principle has been fully withdrawn, it drops down lifeless almost in an instant †.

Such, then, are the radical constituents of the air we breathe. The reader, however, will recollect, that while endeavouring to illustrate the discovery of Dr. Black, I mentioned that lime water when exposed to the atmosphere becomes turbid, and that when we examine into the cause of

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* Lavoisier's Elements of Chemistry.

† On this account the name of Azote has been given to it, which signifies "destructive to life."

this, we find it to be from an absorption of carbonic acid gas*; this gas must therefore have previously existed in the atmosphere: so in fact it always does, but in so extremely small a portion compared with the others, and in such manner, that it is regarded rather as an extraneous combination than a constituent principle.

Thus I have aimed at giving my reader an insight into the chief circumstances that have contributed to the advancement of chemical science; which, as before remarked, is so intimately connected with medicine, that to improve in the former is (provided proper application be made of knowledge) to proceed in the latter. I shall now go on to give a rapid sketch of modern physiology—a science which is to the physician nearly the same as navigation to the mariner.

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* It has already been observed that Dr. Black named this substance fixed air; it has since acquired the denomination of carbonic acid, from its having been ascertained to consist of a certain principle, *carbon* with oxygen. See Note, p. 96.

CHAPTER VI.

As physiology of medicine, so is anatomy the foundation of physiology. It is indeed to our more accurate acquaintance with structure, that we are principally to attribute our superiority of knowledge over the antients in respect to functions. In the present day, we securely go round the circuit of the body in search of fresh discoveries, as we have charts to direct and compass to steer by: nor, can we be surprised at the many misventures of our predecessors in this pursuit, when we recollect that almost the whole amount of their real information was, according to the somewhat coarse statement of a modern physiologist, merely this, that the aliment is received by one orifice, and the fæces make their exit by the other.

As preliminary to a more particular enquiry into those laws of animated nature, which the recent discoveries in chemistry have so materially assisted in disclosing, it will be permitted me to chalk out a faint outline of the mode in which, as far as we are informed by anatomical research, life and being are sustained; or fresh matter is added to, amalgamated with, and supplies the incessant demands of the system.

Aliment, received into the mouth, broken down by the teeth, and further perhaps prepared by the saliva, is introduced through the œsophagus into the stomach. In this organ, which in man has some resemblance in figure to the bag of a bag-pipe, the food undergoes another change before it is transmitted to the upper part of the long and convoluted canal of the intestines; it is here where the most important alterations are effected; for, by innumerable small orifices, which open upon the interior surface of the upper portion of the intestinal tube, the nutritious is separated from the fæcal part of the ingesta, with the secretions that have been mixed with it, is conveyed through a series of vessels and glands connected with these vessels, into an oval sac, called the receptacle of the chyle; into this sac the lymph, a fluid secreted from every part of the body, is likewise conveyed; and the chyle and lymph now ascend a tube, which, originating in the sac just referred to, runs up on the left side of the body, passes the chest, and, arriving at the neck, pours its contents into a large vein situated at this part.

The aliment then received by the mouth becomes chyme in the stomach, a mixture of chyle and fæculent matter in the upper portion of the intestines, fæces in the lower portion of the intestinal tube, chyle in the mesenteric vessels, and, at length, blood in the blood vessels; from which last fluid all the different secretions and excretions find their source.

But in order to render the blood suited to supply its various requisitions, it is absolutely necessary that it be incessantly subjected to the agency of air; hence we have another function not yet mentioned, but which is an indispensable part of the process of nutrition, namely, respiration; by which a constant and intimate communication is maintained between our bodies and the air which surrounds them.

In retracing then, and in a more minute manner describing the functions of the living body, we may properly divide these functions into Digestion, Respiration, and Assimilation, which last includes Absorption, Secretion, and Excretion.

Of Digestion. To account for that change which is operated upon alimentary substances when received into the stomach, the fancy and ingenuity of man have framed many hypotheses. What is the reason that the materials used as food, which in some animals, with man in particular, are multiform and dissimilar, are united in the stomach, and form one homogeneous pap like substance, which is altogether unlike any one of the ingredients composing the aliment, and even bears no resemblance to the composition which a mixture of these ingredients out of the body would produce?

The phenomenon of digestion had been in a vague manner ascribed to heat; but the first systematic conjecture of the process by which the effect is produced, was that of a mechanical action in the stomach. The food which had been triturated by the teeth, was supposed to be still further comminuted by the stomach, and by the action of this organ to be at length reduced to a pulp. But, that the conversion of food into chyme is independent of such power or agency, the experiments of Spallanzani, and especially of Stevens, have fully demonstrated: it has been shewn that food inclosed in perforated tubes and balls composed of metal, and, in consequence defended from trituration, is convertible into chyme, the substance inclosing it remaining unchanged. It was indeed sufficiently evident before these experiments, that mere trituration was incapable of producing chyme, because, as I have above observed, this substance never could be produced out of the body.

Physiologists disposed to refer vital phenomena to chemical laws, conceived that the formation of chyme was brought about by a species of fermentation, a word to which no very precise ideas were fixed when it was first employed. "All that could be meant by saying that the conversion of food into chyme in the stomach is owing to fermentation, was merely, that the unknown cause which acted during the conversion of vegetable substances into wine or acid, or during their putrefaction acted also during the conversion of the food into chyme, and that the result in both cases was precisely the same."

When we now speak of fermentation, we mean that slow decomposition of animal or vegetable matter, which under certain circumstances, and at a given temperature, occasions new and particular compounds. A proper admixture and due temperature being then the only requisites in the production of fermentation on fermentable bodies, it follows, that were digestion a mere fermentation, all that could be effected by the stomach, would be merely that of supplying an appropriate degree of heat.

But, let this degree of heat be applied out of the stomach to some substances which in this organ are essentially changed in a very short period, and they shall continue unaltered for days, or weeks, or years; and, it has further been properly observed, that were the conversion of aliment into chyme occasioned by fermentation, digestion would proceed equally well in the œsophagus as in the stomach: now it has been noticed, that upon laying open the stomach and œsophagus of fish that had swallowed animals too large to be contained in the stomach, that part only which was in the stomach was converted into chyme, while that in the œsophagus remained unchanged.

That the food contained in the stomach is at times subjected to a species of fermentation is very evident, from the eructations which often follow its reception and admixture into this viscus; but it is well known that these discharges of aereal matter occur more readily and copiously, when the stomach does not without difficulty digest its contents; marks of fermentation are then signs of *in*digestion, and digestion and fermentation are processes widely different.

As it regards prime agency, it is indeed in this as in other functions of life, that we can find nothing analagous to it in the phenomena of inanimate nature; and after all our toil, we must be content with the conclusion, that digestion is produced by living energy: here however we must be aware of escaping (if I may be permitted to revert to my own expressions) from physical, only to plunge ourselves into metaphysical error. "To give a local habitation and a name" to a presiding principle, and refer digestion to its agency, may serve the purpose of the poet, but ought not to satisfy the desires of the physiologist.

That digestion is dependent upon living energy is sufficiently evident, from the fact of the process being impeded or accelerated by a varied state of the mental faculties. Let food, exactly the same both in quantity and quality, be taken by an individual at different times, and precisely under similar circumstances, except the variation now referred to, and at one period digestion will proceed with freedom and facility, while at another it will be almost totally prevented. Every hypochondriac has a feeling acquaintance with this fact.

But this, as an ultimate fact in the œconomy of animated nature, we must be careful not to view in the light of an ascertainable cause; for, if with Helmont we attribute this living agency to an Archæus or superintending principle resident in the stomach, we merely add to the number and increase the complication of terms, without advancing one step in useful science—"We darken counsel by words without knowledge."

Instead of so doing, it is the business of the physiologist to ascertain the result of such agency, or to obtain an acquaintance as far as it is in his power with the several circumstances that have place in the digestive process, and which may justly be considered as strictly chemical.

It has already been said that food is converted into chyme in the stomach, although inclosed in perforated tubes or balls, composed of materials which are incapable of this conversion; now if this same aliment be inclosed in the same balls without any perforation in their sides, it will merely undergo that change which would take place in it exposed in such manner to the same temperature out of the body; a liquid then, or something of sufficient tenuity to permeate these perforations, is evidently concerned in the production or formation of chyme.

What is the precise nature of this liquid? The solution of this question has been found exceedingly difficult, for the several methods that are had recourse to in order to obtain it are all full of fallacy;—if for instance vomiting be excited, a method of procuring the secretion sought for which Spallanzani tried upon himself, it is impossible to say how far the matter thrown off from the stomach may be mixed with saliva, mucus, or any other ingredients;—if an animal be killed, and the contents of the stomach be collected, such contents may still consist of a greater or smaller admixture of substances extraneous to that of which we are in search, and the same impediments lie in the way of every other method employed to procure this material.

All that we have been able hitherto to learn amounts to very little more than this, that in different animals a fluid is secreted by the stomach, which, according to the variety in their digestive powers, is of a different nature, and suited to the species of aliment that they are severally destined to receive; for the gastric fluid, collected with as much care as possible from two animals not of the same species, will, even out of the body, exhibit a varied degree of solvent powers; the gastric fluid of each dissolving with most readiness that kind of aliment which is most easily digested by the stomach of such animal.

We know further that the chyme-producing or digesting power acts with more facility, according as the substances upon which its agency is displayed, are divided: it is on this account that, cæteris paribus, digestion invariably proceeds with more rapidity if the food be well masticated: one cause indeed of digestion being facilitated by mastication, is the consequent larger supply of saliva, which at any rate serves to dilute the aliment, and possibly answers a more important purpose;—it has been supposed by some to communicate oxygen.

We have thus followed the food from its reception into the mouth to its digestion in the stomach; from its being aliment to its becoming chyme—but it is not as chyme that it enters into the composition of the blood; it has already been said, that the chyme is sent from the stomach into the intestines, and there undergoes another essential change—a change which is as difficult to account for as that of the formation of chyme. From the difficulty of collecting chyle, this has scarcely been analyzed with any degree of accuracy; but it has been almost proved, that chyle as well as chyme is always in itself the same, whatever difference there may have been in the ingredients that have contributed to its formation; or, in other words, whatever varieties there may have been in the aliment that has been taken into the stomach—that if an individual for instance, accustomed to live upon a mixture of animal and vegetable substances, were for some time to take the one or the other exclusively, the chyle formed would still, in quality, be the same.

Another fact which is worthy notice, respecting the formation and composition of chyle, is this, that if food be taken into the stomach, which in its appearance and actual qualities approaches to the nature of chyle, such food is primarily converted into chyme, by consequence loses its chylous properties in the stomach, to be resumed in the chyle making portion of the alimentary canal; nor, perhaps, is this regeneration effected with more facility, or the chyle produced in greater abundance in the proportion, certainly not in the exact proportion, to the approximations of quality just referred to.

For example. "Chyle is a white-coloured liquid, very much resembling milk." Now analogy would dispose us to the conclusion that this matter (chyle) being in a manner the source and essence of nutriment, the greatest quantity of nourishment would be introduced into the system by the use of milk as an article of diet: this, however, is not absolutely and invariably the case; for milk, when acted upon by the gastric juice, ceases to be milk, is converted into chyme, and, consequently, loses its chylous resemblance. To this principle, and the modifications of which it is susceptible, I shall have again to request the reader's attention when treating on the very important subject of Assimilation;—a subject curious and important in itself, but more especially so in reference to the theory and management of diseases.

Chyle, as above noticed, separated from the fæcal portion of the alimentary mass, is conveyed into the thoracic duct, there to be mixed with the lymph, with which it passes directly into the blood vessels, and through them is conveyed to the lungs, where every particle of this chyle, now a component of the blood, is exposed to the agency of the atmospheric air; and, by this exposure, the blood undergoes so complete a change, in its principles, in its appearance, and in its qualities, that the quo modo of this change calls for especial investigation. It is in this particular that the physiologist has been principally assisted by those recent discoveries in chemistry, an outline of which I have endeavoured to trace in the preceding chapter. In further, therefore, attempting to give a succinct exposition of our present state of knowledge in regard to the respiratory function, I must beg the reader to bear in mind the leading facts there stated.

Of Respiration. Anatomical and physiological experiments having informed us that it is necessary for the whole mass of blood to be subjected to the action of air, it becomes a natural enquiry, what are the effects operated by this action? and, in endeavouring to ascertain these, we are led of course to an examination of the blood that has undergone this exposure, as well as of the air that has been concerned in the effect produced.

The changes produced by respiration in the air, are a diminution of its bulk and specific heat, a disappearance of a great part of its oxygen, and the addition of a quantity of carbonic acid gas: while the blood, by its circulation through the lungs, and consequent exposure to air, is changed from a dark purple to a florid red colour, the chyle has totally disappeared, and its specific caloric is increased.

Whence and for what purposes are these changes produced? The reader, who may now for the first time be made acquainted with them, will readily trace the resemblance of the respiratory process to the process of combustion; for in either, both the air and the material upon which its influence is displayed, are essentially altered.

There has been some variation in the result of different experiments made with a view of ascertaining the measure of oxygen that is consumed in respiration in a given time; but a writer of much credit and celebrity gives us the average portion of a man's daily consumption, rather more than twenty-five cubic feet. "Now, since the oxygen amounts to about one-fifth of the atmosphere, it follows, that in a day a man destroys, or renders unfit for supporting combustion and respiration, no less than one hundred and twenty-five cubic feet of air."

What becomes of the oxygen thus lost to the air? This question appears to be still *sub judice;* some supposing that as the blood passes through the rete mirabile of the lungs, it actually imbibes oxygen, which is dissolved by and becomes a constituent of the blood; while others imagine that the whole of the oxygen consumed is employed in the formation of the carbonic acid gas, which appears in its stead.

On either supposition, and it would be inconsistent with my plan to go into the discussion, it necessarily follows that a most important change is effected by respiration on the vital fluid;—whether this change be the loss merely of carbon, which is said to be three-fourths of a pound in the day, or whether with this loss of carbon, and according to some hydrogen, oxygen is received by the blood.

I shall here only just stop to notice an ingenious conjecture on the emission of carbon from the lungs, which I shall use the freedom of giving in the words of an author already quoted, to whom the chemical world, England in particular, stands highly indebted. "The change of chyle into blood," says Dr. Thomson, "I presume takes place in the blood vessels. Indeed the blood is a liquid which is constantly running through a suite of changes. Hence it is kept of a similar nature only by the constant influx of new matter, which is as constantly manufactured into blood. It appears, from the most accurate observations hitherto made, that neither chyle nor lymph contain fibrin *, which forms a

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* A chemical principle, of which the muscular substance is in a great measure composed.

very conspicuous part of the blood. This fibrin is employed to supply the waste of the muscles, the most active parts of the body, and therefore, in all probability, requiring the most frequent supply. Nor can it be doubted that it is employed for other useful purposes. The quantity of fibrin in the blood, then, must be constantly diminishing, and therefore new fibrin must be constantly formed. But the only substances out of which it can be formed, are the chyle and lymph, neither of which contain it. There must therefore be a continual decomposition of the chyle and lymph going on in the blood vessels, and a continual new formation of fibrin. Other substances also may be formed; but we are certain that this *must* be formed there, because it does not exist previously. Now one great end of respiration must undoubtedly be to assist this decomposition of chyle, and complete formation of blood."

"It follows, from the experiments of Fourcroy, that fibrin contains more azote, and less carbon, than any of the other ingredients of the blood, and consequently also than any of the ingredients of the chyle. In what manner the chyle, or a part of it, is converted into fibrin, it is impossible to say; we are not sufficiently acquainted with the subject to be able to explain the process. But we can see, at least, that carbon must be abstracted from that part of the chyle which is to be converted into fibrin. Hence, as the process of blood making advances, there must be a greater and greater redundancy of carbon in the liquid. Unless this redundancy were removed, the process could not go on, and probably the whole would run into putrefaction. We may conclude, then, *that one great use of respiration is to abstract this carbon* by forming with it carbonic acid. How this is performed, indeed, it is impossible at present to explain; but the fact is undoubted."

Whether then in respiration carbon be merely given out, or oxygen become likewise combined, with the blood; in either case the researches of the moderns have served to explain in a most interesting, and, as far as they extend, satisfactory manner, the modus operandi of a function, the chemistry of which, less than half a century since, scarcely went further than the knowledge which the most illiterate must have possessed, in common with the most adept in science,—that air is necessary to life *.

But the lungs answer another purpose in the animal œconomy, beside merely changing the composition and qualities of the blood. It has been proved, that the temperature of all animals depends upon respiration, for beside that animals, which do not breathe, have an interior heat, very little superior to the medium in which they live, and are hence called cold-blooded animals, it has been ascertained further, that the temperature of breathing animals is propor-

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* This loss of carbon, and consequently more complete animalization, takes place by the skin as well as the lungs; for it has been proved by experiment, that the external surface of the body constantly emits carbon, carbonic acid being a product of perspiration as well as of respiration. Whether it is transpired as carbonic acid gas, or formed into this gas by the oxygen of the atmosphere, seems, as in the case of respiration, to be uncertain.

tioned to the magnitude of the lungs, and the capacity of these organs for duly performing their functions.

Birds, for example, consume, in proportion to the size of their bodies, a larger proportion of air in respiration than man, and have, in the same proportion, a higher degree of animal heat; for whatever may be the changes in the exterior temperature, their interior heat is pretty uniformly preserved at 103° or 104°, while, in man, it is not more than 98°, and in fishes, which have not respiratory organs, it is, as just stated, at no time much above the temperature of the medium in which their existence is maintained.

In what manner then do the lungs give us this almost independence of the extraordinary vicissitudes to which we are exposed in external temperature? In replying to this question, we must again revert to the valuable discovery of Dr. Black respecting the laws which regulate the combinations of caloric.

It has been found, not only that air which is expelled from the lungs in respiration, contains a diminished portion of latent or specific heat, but that the blood, which has been subject to the influence of this air, has at the same time had its quantity of specific caloric augmented, for venous blood is converted in the lungs into arterial blood, and the latter has much more combined or specific heat than the former; now, the change from arterial to venous blood is gradual, is perpetual, is in every part of the system; hence then, the perennity of animal temperature, and its greater reference to the size and capacity of the lungs, than to variations in the state of the atmosphere*.

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* It has already been said, that with respect to the emission of carbon, the lungs and the skin perform similar offices in the animal œconomy. As it relates to the regulation of heat, it should appear that the respiratory and perspiratory processes are not quite so much in unison. "As in respiration," says one of the most able of our medical writers, "a gas is constantly converted into a solid or fluid, and thus heat evolved, so in perspiration a fluid is continually converted into a vapour, and thus heat is absorbed." Every one indeed knows that perspiration is a cooling process, and all who are acquainted with chemistry know likewise, that

It is not meant to be said that there are not difficulties still attendant upon the theory of respiration, which await to be solved by further research; but thus much is certain, that the heat necessary to maintain life is produced principally if not wholly by the respiratory function; that by this function the blood is essentially changed, so as to be fitted for the various purposes of the animal œconomy; and, that this change is accompanied by a corresponding change in the atmosphere, both in its form and qualities, very similar to that which is operated by the process of combustion.

But for what purposes, beside that of developing and maintaining animal heat, is the blood thus prepared as it passes through the lungs? If in travelling the circuit of the animal frame, and remarking all its bearings and peculiarities, we

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this effect is produced by evaporation. There are some circumstances, however, which run counter to the supposition that the regulation of animal temperature is left entirely under the guidance of the perspiratory organs. See Dr. Reid on Consumption.

find one particular to arrest attention and demand admiration beyond another, it is this, that from the same fluid (the blood) a variety of products are incessantly forming, some of which are as different in appearance, in quality; in every thing, from others, as arterial, oxygenated, or decarbonated blood, differs from the chyle and venal blood out of which it is made.

From the same fluid for example, and at the same instant, saliva is secreted from the salivary, tears from the lachrymal gland, products which, not merely in appearance and consistence, but likewise, in chemical composition and qualities, are very different; and this observation may be extended to all the other secretions and excretions of the body; whether, as in the examples just adduced, the matter generated be principally discharged, or whether it be added to or more positively form a constituent of the body.

It is this last process to which the word assimilation is usually applied—a process by which foreign and dead matter is made to constitute an actual portion of the integral animate body—a process by which aliment is, as we have seen, first changed into chyme, then into chyle, then into blood, and lastly into the various constituents, solid and fluid, soft and hard, of which the body is composed.

It is this surprising fact in the animal œconomy which, as especially connected with medicinal agency, demands a particular investigation.

It has already been said, that chyme and chyle, although made up principally of those ingredients which compose the aliment, are in their nature and composition essentially different from that which would be formed by a mere mixture of these ingredients; nay, further, that chyme and chyle, the last of which contains the principles, at least the rudiments, if I may so express it, of nutrition, is in all instances the same, whatever may have been the material out of which it has been created.

We have seen further, that these successive changes are so essential to the blood-making, nutritive, and assimilating processes, that even if a substance approaching to the nature of chyle be introduced into the stomach, such substance does not pass on untransmuted to the chyle containing organs, but, in common with every other digestible matter, becomes first chyme in order to be reconverted into chyle; this indeed would be the case were chyle itself, or even blood, to be received into the stomach; the blood would first be broken down into chyme, then into chyle, thus to be conveyed through the lacteals to the blood vessels.

Here then we find chemistry yielding obedience to a superior power. Chemical action is the result of affinity, but, in the phenomena now under notice, this principle (affinity) is no longer left at liberty to display its tendency, all the substances which are brought together in the stomach, and upper part of the intestines, being forbidden to assert their relationship by the mandates of vital impulse; for, allowing as we must, that chyme, and chyle, and blood, and the various secretions and excretions of the body, are chemical compounds, "and that the assimilation of the food consists merely in a certain number of chemical decompositions which that food undergoes," yet the question recurs as to the primum mobile; for why, merely from a different state of the animal spirits, should substances taken into the stomach be in a greater or less degree permitted to display that mutual disposition to combination, which, when out of the body, or when animation has entirely fled the body, immediately commences.

Further, it has been said that from the same mass of blood, and consequently from the same chemical compound, very dissimilar products are engendered, according to the demands of the system. Let this blood be conveyed to one part, and there it shall deposit osseous matter (phosphate of lime); to another, the substance (fibrin) of which the muscles are principally made up; while, from the blood circulating through the brain, the cartilages, and other organs, albumen is chiefly extracted, and this, in all instances, without any additional quantity of matter in the several parts where these several compounds are formed.

We find this very remarkable principle of intussusception, as it has been named to characterize even vegetable life, for in plants, while the vital principle is operative, this formation as it were of new matter, is incessantly going on. I have elsewhere referred to *, and here again shall adduce an example from the very admirable work of M. Richerand on physiology to illustrate this fact. "The marine plant," says M. R. "the ashes of which form soda, if sown in a box filled with earth that does not contain a particle of that alkali, and moistened with distilled water, furnishes it in as great quantity as if the plant had been growing on the borders of the sea in a swampy soil, always inundated by brackish or salt water." In this instance, we

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* Gregory's Encyclopœdia, Article Physiology.

find the principle of nutrition and assimilation to be the same, as when aliment, containing no phosphate of lime in its composition, forms the basis of chyme, of chyle, and of blood, from which last this matter is drawn in copious quantities.

If the reader should be so indulgent as to go with me through the next chapter, the reason then will be more fully seen of my enlarging on this great characteristic of life—this converting or as it were creative power of the vital principle. I shall conclude the present division of my subject by saying, that this faculty is not without its limits and modifications; for some substances shall in a manner insinuate themselves into, and become parts of an animal or vegetable, nearly in the manner of chemical attraction; and, without undergoing that actual change, which in most instances is operated upon aliment by vital agency.

There are, for instance, some substances that are incapable of conversion into chyme or chyle, which substances, however, the chyle being formed, have an affinity with one of its ingredients or products, and, by consequence, when they have been taken into the stomach, and have passed into the upper part of the intestines, combine chemically with the chyle, and, thus combined, pass on into the blood vessels to be thrown out together with that substance with which it has this affinity.

Thus madder has an affinity to phosphate of lime. Now, when this substance (madder) is mixed with the food of animals, it is not changed into chyme or chyle, but, having an affinity for a material which is to be one of the products of chyle or of blood, passes from the stomach through the lacteals, and circulates with the whole of this fluid as a constituent of an homogeneous mass, and is only separated with the separation or deposition of the matter by which, though itself in a manner latent, it had been attracted into the blood. A proof of this principle has been afforded by the well-known experiment of mixing madder with the food of animals, during which time the bones receive a colour of which they are immediately deprived by the cessation of what had occasioned it—a circumstance not merely demonstrative of that fact to establish which I have adduced the example; but, which likewise, serves to shew that there is an incessant destruction and renewal of those particles which enter into the composition of a living body. We have therefore evidence at the very least approximating to complete demonstration, that our bodies at one time do not contain a single particle of the same matter of which they are composed at another; thus, while consciousness teaches us our continued identity and individuality, physiology shews us that we actually become at different periods of our lives new existences—that we ourselves, and those to whom we are attached by sympathy, have not perhaps one atom of the identical matter of which our bodies were formed when such attachment commenced;—a fact which has been brought forward with some fairness as an argumentum ad absurdum against the creed of the materialist.

But I am widely wandering from my subject, namely, the application of physiological doctrines to medical practice—a subject which I shall endeavour to discuss in the ensuing chapter.

CHAPTER VII.

IT has been my endeavour in the two preceding chapters, to give the reader an insight into the nature and objects of chemistry, to illustrate the great improvements of the moderns in this department of knowledge, and to shew the intimate connection of chemical with physiological science. It now remains for me to state how far, in my opinion, chemistry has and may be rendered subservient to the advancement of medicine, and how far its powers have been miscalculated, or its province mistaken, in regulating the administration of remediate agents.

On the false applications that have been made of other sciences to the science of life, I have had before occasion shortly to animadvert; and it were injustice to our ancestors, whom in the plenitude of modern learning we are too apt indiscriminately to censure, not to admit that even in this our day, when the boundaries of science are more strictly defined, and in a manner defended, a menace, at least, now and then breaks out of that restless excursive spirit, which disdains limitation and defies restraint.

Since the time of Lavoisier, we have really heard, both in this and other countries, so much, and in such a manner of oxygen, that we almost sicken at the sound; nevertheless the most extravagant of the *savans* in the present time, even in their wildest flights of hypothetical conception, still in general, retain sufficient sanity to be conscious of their wanderings—an apology which could not be made for many of the philosophers —the *viri graves et docti* of the times that are past.

A very few examples will suffice as specimens of hasty deductions from unwarrantable premises, which have been afforded by the new theories of chemistry and of medicine. I shall then go on to a more particular investigation of the subject under notice.

Any thing like medical novelty, in the shape of system, has for the most part been made to apply especially to fever; perhaps on account of the almost universality of this complaint, as there is scarcely any deviation from the standard of health, indeed there are very few local disorders but are accompanied, sooner or later, and in a greater or minor degree, with that general languor and irregular excitement of the circulation by which fever is constituted. No wonder then, that after the numerous but abortive progenies of ingenious labour in this department of medicine, the Lavoisierean discoveries, which, from their very nature, attached themselveles closely to medical speculations, should be brought to bear on the subject of fever.

It happened that the greater number of remedies, which experience had proved most efficacious towards subduing or arresting the progress of fever, were substances containing a large proportion of oxygen; it was therefore precipitately inferred, that the essence of fever was the absence of oxygen, and that to oxygenate the frame would be to cure the disorder—a conjecture, which, variously modified, served in its discussion to occupy volumes.

Against luces venerea mercury had long maintained its claim to be considered as a specific: but in its crude metallic state, this substance, in whatever quantity taken, has no influence upon the disease; it is only when combined with oxygen that quicksilver is antivenereal. To oxygen then did our theorists attribute all the virtue of this metallic oxyd; and, as in fever, so in this last affection, medicinal agency was supposed to be merely a species of oxygenation. —Hence the extensive trials made of some of the acids as substitutes for mercury.

Nay, from this loose mode of reasoning, the actual convertibility of one disease into another was supposed, merely by an interchange of chemical principles. That lividness of the lips and gums, that foulness of the teeth, that fœtor of the breath, that general languor and lowness which characterize scorbutic complaints, were conceived to argue a deficient oxygenation—a notion which received support from the efficacy of acids as antiscorbutics:—phthisical and hectic affections are marked by characters the reverse of those just noticed; here, the hard pulse, the flushed crimsoned appearance of the face, the transparency of the teeth, the foulness of the skin, the comparative clearness and cleanness of the fauces, and the vivacity of mind, denote, as it was imagined, a superabundance of the oxygenous principle. It will create in the reader some surprise to be told that one of the most able of our medical writers inferred from these slender premises, and with some confidence too, published his opinion, that we might learn to cure consumption, which had hitherto been, and is still alas! an incurable disease, merely by impregnating the system with scurvy—a scurvy joke the reader will say, but I can assure him it was proposed in good earnest.

But it were an unnecessary occupation of time to go the whole round of those conjectural extravagancies that have grown out of the antiphlogistic principles;---the task would be also invidious as well as superfluous; for the ferment has now pretty well subsided, and the use of chemistry in medicine has come to be more temperately and of course more duly appretiated.

It will not be necessary to adduce evidences for the purpose of proving the advantages we have gained as well in the management of those maladies just mentioned as in many others, by the light which the new chemistry has cast on the constitution of the animal frame, by the explanation it has afforded of the natural functions, by the particular connection it has pointed out between respiration and digestion, and by the facility which it has given to the analysis, both of the principles and products of an organized body; indeed, without any special and apparent application of the doctrines of chemistry to the theory of disease, the two sciences of medicine and of chemistry are in a manner so interwoven the one with the other, that, as I have before said, an advancement in the latter cannot fail, under proper directions, to bring with it an improvement in the former.

Still I think there is some little room left for animadversion upon the chemical practice of medicine, if I may so term it, of a less enthusiastic nature than that to which I have above alluded. I cannot help fearing that much of our present theory and practice is founded upon an insufficient attention to the fact, that the affinities of an organized body are under the guidance of a superior influence---namely, vital agency: it was from this persuasion that I was induced in the preceding chapter to insist, and dwell particularly upon that singular principle in the animal œconomy, by the exercise of which new matter is actually created, if the expression may be used, to answer the exigencies of the system.

To revert to this principle as introductory of what I am about to advance in reference to its connection with the practice of medicine. Suppose I wish to produce a more than common discharge from any one of the secretory or excretory organs, say, for example, the salivary glands: the product of these glands is saliva, and saliva consists of the following ingredients, Mucilage, Albumen, Muriate of Soda, Phosphate of Soda, Phosphate of Lime, and Phosphate of Ammonia. Now by introducing these principles, any or all of them, into the stomach, or even applying them more immediately to the glands, should I accomplish my object of procuring a superabundance of saliva?---No, this purpose would only be effected by the application, immediate or intermediate, of those substances or powers which experience had proved to have an influence in the *excitation* of those organs, by the action of which saliva is generated---nay, the mere sight of a savoury viand, without an actual addition of matter in any way to the system, will sometimes in a moment occasion the formation of all these products, which could in no time or way be manufactured out of the ingredients, externally or internally used, which the chemists tell us constitute saliva.

To apply. Several maladies come under the cognizance of the physician, the characteristics of which, as far as effects are concerned, are in some cases a deficiency, in others an exuberance of secreted or excreted matter; thus the disease incident especially to children—Rickets, has for its essence a diminished quantity of the phosphate of lime—a substance of which the hard part of the bones is made up. On the other hand, in Diabetes, we have an inordinate flow of urine, which, in one species of the complaint, is altered in quality as well as augmented in quantity;—again, protracted Gout frequently occasions the excretion of a particular kind of matter; and a Stone in the bladder or the kidneys is formed upon the same principles.

Now, what appears to me the mistake on the part of the theorists to whose speculations I am alluding is this, that they too precipitately, and in too unqualified a manner infer the generation, and opposition, and neutralization of matters, *in*, from that which they have noticed *out*, of the body; it is this mistake indeed which constituted the errors of the humoral pathology—errors which were partly exposed by a more correct anatomy, partly by the arguments of the solidists, and which were more thoroughly refuted by the tenable part of the doctrine of excitement.

Let us, by way of illustration, go over in a cursory manner the principles which ought to regulate the treatment of the disorders just mentioned: and first, how often do we see a rickety, diseased, and deformed infant, restored to health, and strength, and straightness of limb, solely by a judicious use of what Dr. Brown calls the exciting powers; that is, by nutritive food, good nursing, and pure air, with the occasional administration, perhaps, of chalybeate medicines; this child, during a given time from the commencement of its cure, shall not have taken into its stomach one particle more of the phosphate of lime, or of those ingredients, which by any admixture out of the body, could have formed this substance, than in the same space of time it had received during the worst period of the malady, How then has the cure been accomplished? Whence have the bones which, from want of the principle in question, were soft and curved, been furnished with it and are now firm and straight? Because simply we have restored that kind and degree of *excitation* in the osseous vessels, which were necessary to enable them to extract this material out, or form it from, the blood.

Again, in Diabetes, we have defective chylification and assimilation, we have consequent emaciation, and chylous or at least saccharine urine. This is disordered action; and the consequence of such disordered action is the discharge of that something which, had all been right with the assimilating and digestive organs, would have proved the pabulum of fresh matter to the body. Do we attempt the cure of this malady by examining the substances excreted, and throwing into the stomach a fresh supply of such substances? In this attempt we should certainly be foiled; nay, it is this species of matter which experience proves has most tendency to increase the disorder; inasmuch as it is disposed to run into a state of fermentation, and is consequently rendered unfit to form chyle.

Further, as it regards our third example. That kind of inflammatory action which characterizes Gout, is very often productive of a concretion, which we find in a great measure constituted by the lithic or uric acid united with soda; now, an individual, whose system is thoroughly imbued with gout has perhaps lived in precisely the same manner, has taken into his stomach the same aliment, with another, whose constitution does not exhibit the smallest tendency towards the disease in question. Does not this prove, or, at least, go a considerable way towards establishing the inference, that an athritic is not such on account of a superabundance of this urate of soda floating or circulating in his system, but, because he is constitutionally obnoxious to that species of irritative action which has the power of generating this substance from the blood? And does not this view of the subject lead to an important principle in the treatment of the complaint, namely, that to remedy it is to correct the morbid action by which it is constituted, not to neutralize the substances which are merely the consequences or products of such action?

If chemistry, in the way supposed by some, were operative on any one affection more than another, we should suppose it to be on the stone of the bladder or the kidneys; yet, even here, we shall find, I believe, the most effectual corrections to be those which correct the disposition to the *formation* of stone, not those which decompose its ingredients and neutralize its principles when formed.

When the alkaline medicines came first into use as lithontriptics, it was soon perceived, that in their caustic or pure state they could not be administered in the quantity requisite to produce their effects; the mild alkalies were therefore had recourse to as substitutes, are now pretty generally employed, and, in many instances, with considerable success. But, in this latter case, it is evident that the virtues of the substances in question are not derived from their solvent power, for the carbonated or mild alkalies are incapable of dissolving or decomposing the calcurary concretions, even when applied out of the body. As far, then, as they are at all efficacious, it is in consequence of the faculty which they possess of correcting the tendency to the concretion of stone *.

The reader will not do me the injustice of supposing that these few suggestions are made for

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* Allowing the view which I have taken of the subject to be correct, it follows that the very able analysis of calculi, with which we have recently been furnished by Dr. Wollaston, does not so obviously and immediately apply to practical purposes as might at first sight be conceived. Some concretions prove soluble out of the body by the muriatic acid, others by alkaline leys ;—the inference from this discovery has been, that the mineral acids are lithontriptics in one case, alkaline medicines in the other. But I think that I have perceived benefit follow from the use of both these medicines at different times in the same individual. In like manner Dr. Bree, in his very able treatise on Asthma, shews in what way both acids and alkalies may answer the same purposes in the animal œconomy.

the purpose of supporting the hypothesis of excitement, or any other hypothesis, merely for its own sake.—It is my wish to embark in the service of truth, not to enlist in the slavery of system. Nor would I at all question the possibility of immediately impregnating in some instances, the living body with chemical correctives; my only desire is to check that disposition—a menace of which I think is perceptible in the complexion of some works, even of the present day, to overlook the distinguishing characteristics of life, and thus to carry us back into the exploded notions of humours and impurities of blood—notions which taken up and acted on in an unqualified manner, have, I am persuaded been productive of considerable injury.

I have thus essayed a cursory statement of my sentiments on the influence both of Brown's speculations, and the chemical doctrines which so shortly succeeded. I shall now go on to offer one or two remarks on that practice which has recently become so prevalent in this country, and which has called forth the encomiums of some, while it has served for the invectives of others—I mean that founded upon the supposition that almost all the maladies to which the body is incident have more or less connection, either with intestinal impurities and obstructions, or at least with derangement in the digestive organs.

It is the custom of some, I have before remarked, to decry system and principle as at the best an useless encumberance, or serving merely to exercise ingenuity. You will often hear it observed, that however two individuals may differ in theory they agree in practice, and that disputes on doctrines are disputes on words. Sometimes in physic, as well as in metaphysic, this kind of scepticism respecting the application of principle is justifiable; but, let what has been advanced in reference to purgative medicines by one school be compared with what has been taught on the same head by another, and then let it be determined whether medical disputations are in every case merely verbal.

When the doctrines of the solidists came to be pretty generally received, as rules of practice in the room of the humoral pathology, and more especially when the death blow had been given to this pathology by the reasonings of Brown, it was conceived, and to a certain extent very justly conceived, that the custom of having recourse to evacuants was founded upon partial, at the expence of general, views on the nature of disease —that the prescriber of purgatives was a prescriber merely to symptoms or effects. "The practice of purging," says Dr. Brown, "from an idea of clearing away stuff from the intestines, is not so judicious even as that of some foolish boys, who place their success in bird catching from the chance of bringing down the nests from the tops of high trees by throwing sticks and stones at them; while other boys, more sensible and alert, climb up and seize every one of them."

But we have lately seen attempts to revive the practice of purgation in all and more than all its former force; and, as the writings recommendatory of this practice are in every hand, it becomes expedient in a professed dissertation on modern medicine, to take especial notice of their probable tendency and influence, otherwise the subject in question might have passed under review while we were engaged in attempting to establish the pro and con of Brunonianism.

"Media inter diversas sententias." That the plan of radical and general excitation is in every instance preferable to mere symptomatic practice, if the expression be admissable, scarcely admits of question; but, it is necessary sometimes to clear the ground before we engage in the contest, otherwise we shall find our principles frustrated and our tactics unavailing. This necessity I have elsewhere adverted to, when considering the treatment of apoplexy.

But further. It is taking too narrow a view of purgative medicines, nay, it is altogether misconceiving the mode of their acting, to suppose them in all cases directly debilitating. In common with others, it has been my fate to witness the sudden and almost total dissipation of diseases, which would on all hands be admitted to argue much weakness, merely by the administration of cathartics, and that too, when they have for a long time refused to yield to stimulant or tonic medicines.

Those convulsive agitations of the limbs, which constitute the affection named St. Vitus's Dance, several species of Epilepsy, and very many maladies beside, which are classed by Brown under the head of asthenic affections, or disorders dependent upon deficient excitement, I have known to submit to a purge as to a charm, after the protracted use of exciting agents could not make them resign their firm hold on the system.

The operation of purgative medicines is fourfold. They in the first instance serve to discharge extraneous matter from the stomach and intestines, which if permitted to remain would prove a source of irritation as well as mechanical obstruction to the influence and operation of exciting agents; they in the second place augment the secretions from the glands of the intestines; they thirdly serve to divert the fluids from other parts of the body; and fourthly they communicate an impulse and activity to the frame universally. Hence their respective use in bilious, in hypochondriac, and in febrile affections, in diseases originating in or connected with a torpid state of the intestinal glands, in apoplectic menaces or attacks, and lastly in almost all disorders of debility.

After this admission, I surely shall not be suspected of party spirit in the few strictures which I deem it incumbent on me to pass upon the gastric and intestinal rage, both professional and public of the day.

It behoves us then in the first place to recollect that the alimentary and intestinal canal observe the general law of the living system, and cannot be preternaturally or forcibly excited, without being followed by a corresponding degree of inaction and debility—that they cannot, to use the words of an author so many times quoted, be cleared out and cleaned like a soldier's firelock. In fact, no one perhaps ever took a purge, or had recourse to an emetic without in some small measure diminishing the tone of the stomach and bowels, and thereby inducing the necessity of having again recourse to its use, which is likely at length to induce a habit in the highest degree disgusting in itself, and calculated in its effects to lay the foundation of painful, protracted, and often irremediable complaints, in and about the intestines.

It ought secondly to be had in mind, that the inactive state of the stomach and bowels, and consequent collection of colluvies in the alimentary canal, often, and I believe much oftener than is suspected, stand, in relation to general disease, as effect rather than as cause. Disorders of the stomach and torpor of the intestines very frequently produce head ach—granted; but does the converse of the position never hold good? Do we not often see affections of the mind produce maladies of the body, and is not one of the most common modes in which these maladies display themselves, a disordered state of the stomach and bowels? Nay, will not blows on the head, will not inflammations and dropsies, and other diseases of the brain often give the first indications of their existence by deranging the œconomy of the first passages? And are these disorders to be resisted solely by resisting some of their effects? Is there not a more radical way of going to work? Do we not by taking cognizance merely, of the stomach and bowels, throw at the nests in place of climbing the tree? And are we not likely, even if we effect our object, to effect it lamely and partially?

I shall be applied to by an invalid, who has every evidence of a disordered state of the digestive or chylopoetic organs—pains and sensations of weight in and about the stomach, a diminished appetite and digestion, flatulence, obstipation, a foul and furred tongue, alternate feelings of heat and cold, with dejection of mind and lassitude of body. Now these two last symptoms, dejection of mind and bodily weakness, shall in general have occasioned that irregularity in the chylopoetic viscera, which are too often regarded as the causes rather than the effects of the prime and principal disease. If it be urged that the general indisposition often obviously succeeds the reception into the stomach of indigestible materials, it is answered, that these very substances are in many cases but relatively indigestible, for, when taken by an individual who is in a state of full and healthy excitement, none of the unpleasant consequences above mentioned shall ensue.

Surely then it ought to be my object, in the management of the complaint, to aim at the restoration of this natural and salutary state of the universal system, by which the disorder will not merely be carried off, but prevented from returning.

Let me further suppose the trial made of the two different methods of remedying the same indisposition. One dyspeptic invalid shall have recourse to his cathartic potion, his antibilious drug, or analeptic pill, and shall *pro tempore* be freed from his distressing sensations; but a little time will convince him that he has "scotched the snake, not killed it;" that he has subdued the complaint merely, not counteracted its cause; it will shortly rise up in judgment against his medicinal course, and if the contest be continued in this manner, the disease will gain strength as the subject of it becomes enfeebled.

On the other hand, he who has gone more systematically to the encounter, who has exchanged the mephitic atmosphere of town for the oxygenous air of the country, his sedentary habits for active employments, shall not have much cause for regret, even should he have left his medicine chest behind him: the deranged functions shall soon resume their wonted serenity, the appetite and strength shall return, and the alvine evacuations shall come to acquire and continue to maintain, that state of regularity which is both the effect and cause of the uninterrupted well-being of the system; and all this, let it be observed, often without even in the first instance the patient's having had recourse to a cathartic medicine.—This statement is not an invention, these comparisons are not ideal, but such as I have frequently had occasion to experience and to witness; and, it is not merely under the circumstances supposed, that the use of purgative medicines may often be well superseded; nay, I have not seldom seen even temporary benefit refuse to follow the evacuant plan, in those disorders to which cathartics are supposed to be most especially applicable; when change of air, change of diet, congenial society, and exhilarating amusements shall accomplish all that is desired. These would hardly be admitted in any system of *materia medica* as anthelmentics or specifics against worms, but I can assure the reader that I have proved them such after almost the whole list of acknowledged remedies, with purgatives at their head, had been tried in vain.

I express myself strongly, from a conviction that the popular rage for purgative courses requires to be strenuously opposed; and I am rather apprehensive, that the character of some medical works, and the practice of some most respectable and able physicians of the present day, however to a certain extent in themselves proper, are rather calculated to encourage than check that propensity in the public, particularly among persons in the higher classes of society, to suppose that their stomach and bowels may be cleared out and cleaned for fresh use, in the same manner as their servants wash their wine glasses. I would rather wish them to be impressed with the notion—a notion which to say the least would be much nearer the truth, that every time they take a purge they take a dram. I would at the same time define a dram, not as it appears in the dictionary, "such a quantity of distilled spirit as is usually drank at once," but a something, whether coming from the druggist's shop, or the distiller's warehouse, which excites a part or the whole of the living system into forcible or preternatural action, to be followed by a corresponding degree of debility, and all its train of distressing consequences; and, for the aptitude of my definition, I would appeal to the cases of those truly pitiable invalids, one or more of whom you see in almost every travelling company you enter, who with sallow sickly countenances, disordered stomach and bowels, and dejected irritable minds, are crowding to Bath or to Cheltenham, or trying other equally vain expedients, in order to restore that natural tone and salutary action of the viscera, which have fallen irrecoverable victims to irregular habits, erroneous notions of disease, and imprudent recourse to remedies;—vain expedients, I say, for the relief they are seeking will be temporary, the excitation they procure transient, till at length their punishment and their sufferings will come to resemble those of Sisyphus—as regularly as they roll away the load, as regularly it will return upon them.

Often and often have my opportunities of observation renewed the impression which the following sentences made upon my mind when I first met with them. "There is no error more common or more mischievous among dyspeptic, hypochondriacal, and hysterical invalids, than to suppose themselves *bilious*. *The bile! the bile!*

is the general watch-word among them; and they think they can never sufficiently work it off with aloes, magnesia, or salts. I once heard the maid of a lady, whom a brisk course of this kind determined by the dread of bile, had brought very near to death's door, observe that "*it was no wonder—for her mistress was never easy but when she was on the chaise perçée*[*]."

It will perhaps be said that I am arguing against the use from the abuse of medicinals; but, admitting the justice, in some measure, of the accusation, I must be permitted at the same time to urge in my defence, what I have indeed before hinted, that the tendency of some modern medical writings goes too much towards countenancing, rather than combating the public propensity to suppose that the living system may be cleared from impurities or obstructions with the same freedom, upon the same principles, and with the same impunity as an inanimate piece of mechanism or machinery.

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[*] Beddoes's Hygëia.

I do not know indeed whether the writings to which I allude are not open to reprehension on another score: it appears to me that there is some danger of the gastric chylopoetic and intestinal hypotheses, if they may so be named, bearing away the mind of the practitioner to the detriment of the patient. Is there not ground for apprehension that the unwarrantable simplification of cause and effect, in disease introduced by the doctrine of excitement, may be succeeded by a simplification quite as unwarrantable, although of a different nature? There is in effect but one disease and one remedy, said the bolder defenders of the Brunonian dogmas; and, almost the same tale is told by the "*digestive organs*," theorists, and the dealers in purgative and hepatic medicines.

It is, we know, difficult to free the mind entirely from particular modes of thinking or acting. We are too apt in medicine, as in other matters, to become *mannerists;* but it is our duty to guard the avenues of thought as much as possible against these enemies to truth, and from time to time make strict enquiry, in order to ascertain whether they may not have found their way among our opinions unseen and unsuspected.

I have already said that it is this comparative freedom of research, which gives us so decided a superiority over those who have travelled before us the road of science: but much remains, much always will remain to be done, for the purpose of avoiding the snares, and escaping the fascinations of systematic conceit.

CHAPTER VIII.

HOW far ought the medical learning of the unprofessional to extend? Just far enough to make them "know how little is to be known," to induce them to consign their domestic systems of medicine to the flames, and to convince them of the utter incompetency of books alone to direct the practice of physic in the slightest degree. This conviction, indeed, one should suppose, did we not see instances to the contrary, would forcibly fasten itself on every reflecting mind.

Suppose that the preceding pages had presented to the unprofessional reader an ample dissertation in place of a hasty sketch; suppose that every disease which has been slightly referred to by way of illustration, had been fully and properly discussed; suppose, if the supposition can for a moment be admitted, a man of sense, discrimination, and science, to come fresh from the perusal of such work, to the bedside of the sick with an imaginary qualification to prescribe for the malady. Where would be the ground of our confidence in the capacity of such a prescriber? Surely we should direct him to "throw his physic to dogs," at least we "would have none of it." For my own part, averse as I am to the mere routiner or mechanical practitioner of medicine, I am free to confess that were the alternative forced upon me of a man acquainted with the art merely by book lore, and a dispenser simply of drugs, whose medical reading had been confined to the reading of a prescription, and who had thus literally "learnt the art by doctors' bills to play the doctor's part," I should prefer this last as the least evil.

In what art is theory alone sufficient to guide the practice? Ask the speculative agriculturist whether he has not invariably been foiled in prejudging the application of his principles to the actual business of cultivation and farming? Is it not notorious that under these circumstances failure always attends attempts at practical innovation? Does not the simple, unscientific, experimental, routine farmer laugh to scorn the plans, and the schemes, and the practices of his book-learned neighbour? And does not the event of a few years prove that the ridicule was not ill founded?

Again, where is the individual, of whatever ingenuity, who, from having learnt the principles upon which any piece of manufacture is constructed, would enter the lists in dexterity with the most illiterate mechanist, whose skill is rote, and competency habit? And yet there are those, who, while they leave chair-making to the professed manufacturer, would confidently undertake the cure of disease; who think that books, if they instruct the faculty, might teach the public; and that every man with a little pains might be his own or his neighbour's physician.

On the part of books, however, which profess public and individual instruction, we have not frequently to complain that they abound in inapplicable theory; it is respecting practice that they pretend to inform: they do not give the rationale of a disease, but they state its name, and designate its antidote.—The *name* of a disease:—some would be surprised to hear it asserted, and yet the affirmation may be easily substantiated, that this, in the sense in which it is employed by the soi-disant instructors of the public, is downright absurdity,—is a gross violation of nature and of truth.

A medical writer, whom in the course of this little tract I have had occasion more than once to quote, compares the denominations of maladies to the ideal forms of the artists—they are selections of features from many individuals, which are made to meet in an imaginary whole—and the comparison is by no means unfortunate. We say, for example, a person is affected with *jaundice;* but whoever met in one individual all the symptoms that are described by authors as characteristic of jaundice?—And again, who, provided his opportunities of observation have been at all extensive, has not in different individuals witnessed them all, and more perhaps than all?

But it is not merely the external signs, but likewise the internal, actual, essential, character of this same jaundice (to proceed with our illustration) that is subject to such variety or want of definite simplicity. Let us go over rapidly the circumstances of the system, which shall give rise to that state and colour of the surface of the body from which the term jaundice originated—this particular hue is immediately occasioned by the diffusion through the system of that fluid (bile) which nature designed only for a particular part. But this diffusion, though a simple effect, is occasioned by circumstances multiform and various: it may be attended by and proceed from an inordinate irritability of the stomach and intestines; it may arise from a too active or too torpid state of the organ which secretes the bile; or it may be occasioned by a more decided obstruction to the flow of this fluid through its appropriate conduits: this obstruction itself may be of different kinds, and may take place in different parts; it may originate in an inspissated or too concrete condition of the bile, which shall at length come to be of that consistence by which gall-stone is formed; it may proceed from a spasmodic stricture of parts in the neighbourhood of the gall-ducts, from which these canals become compressed; this compression may further be produced by a permanently morbid growth of parts, or by a temporary enlargement or misplacement of adjacent organs.

Now the power of detecting these circumstances necessarily implies an intimate acquaintance, theoretical and practical, with the structure and susceptibilities of the animal organization; the removal of the disease of course as necessarily implies the removal of its cause, and yet we meet with persons, ay, and those too, who in other matters are far from evincing weak understandings, who will extol without limits certain compositions as *good for the bile*,---who will refer to their common place-books for *receipts against the jaundice!*

It will, perhaps, be urged, that however necessary it may prove in uncommon and complicated cases to have recourse to professional advice, ordinary and simple occurrences may pass safely under the jurisdiction of domestic doctors or doctresses: and pray who is to prejudge the question respecting the probable nature and event of a disease from its aspect at its onset? This notion indeed of common cases is equally calculated to mislead the unwary, as the denomination of maladies and the publication of their specific antidotes. The poor man to whom allusion was made in the former part of this treatise, had a very common malady, and unfortunately for him, it took too a very common course; that is, it was maltreated, or to say the best, treated with inefficient remedies, till it became a vain hope to make trial of the most efficient.

Let us, as in the preceding illustration, run over some of the circumstances which may connect themselves with this very common complaint---a Cough:---an expression of disorder the most prominent, and to a superficial survey perhaps the single sign of the existence of disease, but which shall be accompanied with characters, that are legible only to the keen glance of practiced vision, denoting "the murderer within."

A Cough may be the result of an irritative, inflammatory state of that membrane, which, commencing in the fauces and nostrils, runs down into and constitutes a sort of interior lining to the lungs; it may be produced by a vitiated secretion from the pulmonary glands; it may be occasioned by a foulness of the stomach, by worms lodged in the intestines, by an enlargement of the liver, and, in fine, by various other causes. Surely, then, the requisitions of the disease must vary with its source, and what excuse but absolute ignorance can be advanced in favour of that effrontery which advertises, or that authority which sanctions "specific and infallible remedies for coughs and colds?"

I have not, it may be observed, taken notice of the varieties of constitution, the difference in sex or age, the sudden transitions of diseases retaining the same denominations, the previous subjection to causes which may materially modify the subsequent malady, this being abstractedly the same, the seasons of the year, and many other particulars, which cannot be appretiated or even learnt without much and well-directed labour, all of which particulars might be brought forward with effect against the pretensions of family medicine.

My allusions to particular modifications of disorder have been made just in the order of their presenting themselves to my mind. I would not, for a moment, have it supposed that the principle I am aiming to establish is in any case whatever inapplicable: it is not as it respects affections of the lungs, or diseases of the liver only, that the term harmless cannot be applied to inefficiency—that the most inoffensive may come to be the most deleterious agents—that meddling imbecility or obtrusive ignorance "may arrest the rescuing hand till the silent but progressive finger of fate move from TIME IS, to TIME IS NO MORE."

If, indeed, I have been lead to the selection by any thing stronger than the impression of recent occurrence, it is the conviction that to disorders in the chest (disorders proverbially endemic in this country) the caution of Celsus "inter *initia* protinus occurrere necessarium est" is most especially applicable; and in this point of view, it may be allowable before I quit the subject, to adduce an example of another affection, different to be sure from those to which I have already referred, but in which an early and prompt discrimination of its nature is, if possible, still more requisite.

There is no one at all acquainted with the nature of disease, who will hesitate to admit, that if there be any possibility of curing the acute Hydrocephalus, or dropsy of the brain---an affection much more common than is suspected, it must be by vigorously employing due measures in the first instance; or, during that irritation which is prior to the effusion of fluid into the ventricles of the brain. It is a remarkable character of this ailment, that at first, for the most part, the bowels seem to be the principal seat of the disease. I say, *seem* to be, for it is only by an habitual converse with morbid affections that we can discern what has been well called "the distinctive physiognomy of diseases, the sort of shade between sameness and difference in symptoms*,"—a capacity of discernment which no system of nosology will supply, no descriptions, however voluminous or however accurate, will give.

Now, the domestic dabbler in drugs, the private practitioner, fraught with the lore of popular systems of medicine, applies to his closet, or his druggist, for something which is *good against a purging or a constipation* (two states of the bowels which at different times present themselves in the first stages of the disease in question); in the mean time, the unsuspected enemy gains ground, in a few days our sapient doctor finds even his sagacity foiled, and he sends for "*further advice*;" like the seaman who should resign the helm to the pilot when the vessel had been dashed against a rock. It is now that the case might quite as well continue in the same hands in which it had been from the beginning---it is irremediable; and the medical man cannot surely find much pleasure in that which is said to constitute the sportsman's delight, namely, being " in at the death."

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* See Dr. Bourne's excellent remarks on ulcers of the lungs, in a work intitled Cases of Pulmonary Consumption, &c. treated with *Uva Ursi.*

I hear one say that the remediable time is often suffered to pass by, before even the observers by profession have observed to any purpose. I grant it: nay, for myself I have no hesitation in further confessing, that many and many time have I been distressed by the painful reflection, that while I have been looking out for the disease, with all the anxiety of indecision, I have lost my patient. But who are the most likely thus to be outwitted by death; those whose very calling it is to be incessantly grappling with this king of terrors, and who thus come by degrees to have an experimental knowledge of his secret wiles, as well as more open modes of attack;---or those who only engage now and then in the contest, and are furnished merely with hear-say information? How much of confidence should we send out with the admirals of our fleets, or the commanders of our expeditions, were we to learn that all the acquaintance they had with naval or military modes of warfare, consisted in written instruction or oral information?

In fact, perfection in all pursuits, where practical application of principles is required, necessarily implies the combination of theory with experience; and, we can hardly lay our account in meeting with many, who for an instant feel disposed to question the necessity of medicine being learned and followed as a distinct profession. But we wish such concession to be more consistent with itself. We wish the inference to be admitted as well as the position; and the inference from the position is plainly this, that quackery, whether it roam abroad bedecked with falsifying advertisements, or lie more concealed and domesticated, is still to be reprehended as injurious in the highest degree to the physical well-being of society.

Let me not be misunderstood; I do not wish to magnify the difficulties or overrate the importance of the medical art, nor would I question the possibility of any good being effected out of the pale of the profession. I only mean to say that when we deviate from regularity we are upon insecure ground, and should we not meet with any mishaps, our safety must be attributed rather to good fortune than to good conduct.

With respect to the government and regulation of the moral constitution. Who is most likely to discern, who is most calculated effectually to extirpate the first shoots of vitious propensities? He whose constant business it is to cultivate and improve the mental soil, or who sets about the task with the blusterous presumptuousness of inexperience and ignorance, furnished merely with a few common-place notions or enthusiastic conceits? And further, let me ask, do the frequent failures of our most judicious instructors prove the total inefficiency of instruction? We cannot expect an affirmative answer to be made to this question by any but the most unreasonable sceptic, or the wildest enthusiast. Let then our public men of influence and power, who fearfully recoil from the very name of methodism, be as fearful to give encouragement to the *methodists of medicine**.

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* If practical medicine be in any case allowable out of professional hands, it is in the sensible and well-informed clergy, resident in obscure villages, far removed from medical attendants, and who may be applied to, *in the first instance,* in the absence of these. A work perhaps is still a desideratum which shall direct in a proper channel the beneficence of this most respectable body of men when under the circumstances supposed. The only one I have met with, that comes near to supplying such requisition is a publication by the Rev. Joseph Townsend, which appeared first under the title of a *Guide to Health,* and has since been called *Elements of Therapeutics,*—both objectionable titles, as neither of them convey an idea of the treatise being of that mixed nature which it certainly is, for it contains much

"But in discountenancing medical directories for the public," I anticipate my reader, "do you not criminate yourself? Did you not commence with a promise to initiate us, the unlearned, into the mysteries or supposed mysteries of your faith?" A short essay was a few days since put into my hands, written by an author* of some celebrity, in a department of enquiry, widely different indeed, from that in which we are now engaged; but, the observations it contained seemed to be capable (lucus a non lucendo) of throwing some light on my present design. The author to whom I refer, lamenting in its effects public inability to appretiate merit in works of art, observes, that "on these weighty grounds the most enlightened republics of Greece were induced to decree by a positive law, that all youths of ingenuous birth should be instructed in the most essential rudiments of the

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valuable information, adapted to the professional student as well as to the general enquirer. Let me, however, again protest against the principle of even this kind of knowledge being *acted on*, unless in cases of immediate urgency.

* Thomas Hope, Esq.

arts of design; in that lineal drawing, a proficiency of which is so necessary to make a man, if not a professor, at least a tolerable judge of works of art of every description; and for these same reasons, Aristotle in his Politics dwells on the importance and the necessity of such a law in all polished and well-regulated states."

"Our rulers," he goes on to observe, "cannot well enact a public and general law of this sort; but every one of our fellow citizens, who feels anxious to give his children the species of education calculated to prove most useful to them, at every period and in every transaction of their lives, should make such a rule for himself."

Now something like what Mr. Hope wishes to see accomplished in the art of design, it is desirable to see effected in the art of physic. We wish for a little more *connossieurship* on the part of the public. We wish the public capacity of discernment to be directed into such exercise as shall enable it to judge on right and wrong; to distinguish, if I may pursue my dissimilitudinous simile, the Thornhills and such like of medicine, the "pretty pictures" of its ill-informed and petit-maitre professors from the legitimate lines, correct delineation, and true colouring of the real artist.

Could this object be achieved, I am almost persuaded that it would go a considerable way towards diminishing the surreptitious credit of every species of quackery, and medicine would by consequence come to be more correctly appretiated. Not, but that the public, as it respects the qualifications of medical professors, whatever may be the case in relation to artists, must always take a great deal upon trust; yet still, I think, with some rudimental knowledge, this credit might be much better and more satisfactorily grounded: beside it is not a question whether or not the public shall be kept in entire ignorance, for such is the importance of health, and such the temper of the times, that bad or good notions on medicine the public will have; and surely if it be deemed worth while to instruct our youths against being cheated into bad taste, the same pains taken on the score of health ought not to be considered as thrown away; and eventually, I believe, it will be found, that opposition to quackery, to have any chance of success, must be grounded on the same principles, whether taste, morals, or medicine be concerned, —in all, false notions are worse than nothing.

But what are these "essential rudiments" in medicine?—Physiology,—a general acquaintance with the functions and laws of the animal œconomy,—a knowledge of the constitution of the human being,—the mode of our connection with, the nature of our relationship to, the powers, external and internal, corporeal and mental, moral and physical, which, acting in various degrees and combinations, are salutary or deleterious,—pursuits pregnant at least with interest if not with instruction, and as far removed from the practice of medicine as the science of geography from the art of circumnavigation.

Now I do not, with Dr. Beddoes, go the length of supposing that the "*sense of health*" may, by proper regulation, be formed and moulded in the same manner as the moral sense, that an early instilment of accurate notions respecting physical right and wrong shall come radically and practically to operate towards full formation of character and complete consistency of conduct; but still, I think, a great deal may be done, nay, I feel pleasure in believing that something has already been effected of absolute and efficient good. Men now-a-days approach something nearer to common sense in their judgment on medical subjects, and this we are in a great measure to attribute to the ingenuous cast of some of our own publications, the authors of which, disgusted with that kind of unfounded faith which had hitherto been reposed in them, and conscious that such confidence is no criterion of real merit, but is given as readily and liberally to ignorant presumption as to modest worth, have expressed a wish that "medicine be brought from its hiding place, and exhibited in the simplicity of science, and the nakedness of truth*".

There is one most essential particular in which I flatter myself in being able to discern the practical benefit of the reformation contended for. I would wish not to give way to an enthusiasm of feeling, but it appears to me that the triumph of common sense and rationality over prejudice and error is proclaimed in the comparatively good health, ruddy countenance, straight limb, and firm muscle of almost every infant you meet with. The cruel tyranny of nurseries and nurses has almost received its death blow. Apartments for rearing children bear less resemblance than formerly to surgeries; and nature, since nature's laws have been better studied, has come to prevail over art.

Nothing in my mind can equal the distress of anxious parents witnessing the sufferings of their helpless offspring, apprehensive at the same time that such sufferings are not "appointed in the nature of things, but are brought about by practices the most absurd and unfounded; in one word, by the most horrid and culpable mismanagement*;" and yet not daring to say nay to the mandates of that arbitrary authority, which established by custom, thus wills, and thus acts, in spite of contending reason. We hear of the decline of such authority with the same feelings that we witness the tottering of a tyrant on his throne; and, that such authority is on the decline, thousands of infants are at this moment telling you by their placid unruffled countenances, and healthy rosy smiles.

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* Dr. Currie.

I have already hinted that from our tendency to extremes, the reaction against this oppressive tyranny is liable to be pushed to an unjustifiable extent of democratic independence. Let us then cautiously guard against injuring our cause. Let us, because art has been shamefully and preposterously misapplied, not conclude that it can never do good; or that disease, because it has often been engendered by ill-directed management, will never happen in the natural and inevitable course of things.

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* Dr. Herdman's Discourses on the Management of Infants.

Let the intelligent parent be put in the way of acquiring a little correct knowledge of the functions and susceptibilities of the infant œconomy. Let the heads of families be made acquainted with something more than the simple facts, that air is beneficial, that cleanliness is congenial, that such and such articles of diet are wholesome, and such deleterious, that binding, and filleting, and swathing the infant are in the highest degree pernicious; let them be initiated into the *principles* upon which these facts are established; let their judgment be brought in aid of their memory, and then we shall find, as I have elsewhere expressed myself, " knowledge and humanity joining issue in the joyous task of averting the artificial evils which ignorance and error have made to attach to the extremely susceptible, though not naturally unhealthy, state of the primary periods of existence;*" and we should further, if I mistake not, find, that parents *thus* instructed would stand prepared to give full credit to the just pretensions of regular medicine; they would be persuaded of the necessity of appealing to that kind of true and scientific, which I have before endeavoured to distinguish from empirical and counterfeit, experience; and both as it respects their own health, and that of their children, they would cease to tamper with deleterious drugs—deleterious when had recourse to improperly, highly beneficial when suitably administered.

The good work I am persuaded is already begun, and I would fain hope that even the present remarkable prevalence of quackery, is like the last struggles of expiring strength—powerful but convulsive—energic but transient.

I shall now close the present treatise by addressing a few words first to the general reader, and then to the professional student.

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* Gregory's Encyclopœdia, Article *Infancy*.

CHAPTER IX.

CONCLUSION.

I Shall first address myself to readers who are not of the medical profession, and beg permission to remind them of the engagement into which I entered at the commencement of these few pages. I set out with a promise of endeavouring to prove that we can establish our claims to public confidence upon more substantial grounds than mystical influence over the imagination, which is, at best, but deceit and fraud. I undertook to demonstrate the impropriety of endeavouring, and the absolute impossibility of effecting, the unprofessional practice of physic; and to shew, that both by the number of discoveries and our present manner of reasoning upon such discoveries, modern justly demands a decided preference over antient medicine.

But the *cui bono* of all this will still, with some, be matter of query. What has medicine after all effected? Does disease commit less ravages than formerly? Do people live longer now-a-days than they did in the days that are past?

To prolong the period of human existence is equally beyond the pretensions and the hopes of medicine. The birth of man is the starting on his journey to the grave; and all that art can possibly effect is to prevent his unnaturally precipitate career, and to conduct him as securely and pleasantly as circumstances will permit along his destined course—to afford him instruction how best to avoid the hazards of the passes he has to go through; and, when by mishap or misconduct he has fallen into snares, to rescue him from them as speedily as possible.

Now it is not recollected by those who question the practical efficiency of modern improvements in the medical art, that we have more to do than we formerly had; that the advance of luxury and refinement is a multiplication of the difficulties and dangers just alluded to; or, that "the development of our moral nature augments and aggravates many of our physical maladies." The main springs of good and evil in this life are placed so near together that you can scarcely exercise the one without at the same time calling the other into action. We cannot enjoy without suffering. Open the sources of pleasure, and pain flows out almost in an equal stream. Savage man is exposed to the fury of the elements; he is instinctively prompted by a sense of inconvenience to form for himself an artificial shelter, next time that he is subjected by accident to the blasts of heaven, he feels them in a double ratio: his artificial source of comfort has given him an unnatural degree of susceptibility to pain;—he increases the former, and necessarily at the same time augments the latter—and so on, from the most simple to the most complicated, from the rudest to the most refined state of human existence.

The only just method then of comparing and contrasting modern with antient medicine would be to suppose the existence of those physical evils, many of which are the mere consequences of our advance in social refinement, to imagine I say the existence of these evils in those days when the resources of medicine were much more slender than they are in our times; or, which would be the same thing, forego all our pretended improvements, and for modern maladies revert to antient methods of treatment. I believe there is no man, however sceptical, who would at this moment trust himself in the hands of a physician equal in sagacity and judgment to Hippocrates, with only Hippocrates' knowledge.

I remember some time since, walking in the fields near London with a scientific friend, who was busily engaged in endeavouring to prove the non-existence of the hydrophobia then prevalent, and in deriding the public apprehension on the score of mad dogs; in the midst of his harangue, a dog came from a hedge near us with a very suspicious aspect and course; I do not say that my friend was the first to fly, but he was at least equally indisposed with myself to put his doctrine to the test of experiment; in like manner, I believe, that those who are loudest in their outcries against medicine would be the last to justify their creed by their conduct. Who, in the event of a malignant fever visiting himself or his family, would forego the astonishing advantages which we possess, and for which we are principally indebted to modern chemistry in arresting its progress or diminishing its virulence? What individual would permit his children to pass through the small pox without the benefit of the cooling regimen, the propriety of which our Sydenham was the first to point out? and we have perhaps but a few years to pass over our heads, when the small pox will only be known as an event in history---as a thing which once was, but is no more.

Now these few examples which I have adduced, and which if necessary might be much multiplied, are only examples of those obvious and direct advantages which have accrued to society from the ameliorated state of medical philosophy and practice; but the study of medicine, properly considered, is more comprehensive than the study of immediately curing or remedying disease. It applies itself in various indirect ways to the requisitions of social life; it comprehends the knowledge and application of physical improvements to the diminution of those ills which luxury engenders; and, without trespassing out of its own territory, it sometimes by dexterous management, makes moral good oppose itself successfully to physical evil.

M. Cabanis well observes, that "the social state necessarily gives rise and occasion to several employments which can only be executed under the inspection of persons conversant with the animal œconomy.—The purification of great cities and harbours; the construction and superintendence of places of public resort, in which a number of persons are crowded together; the draining of lakes and marshes; the direction of canals, and the establishment of aqueducts and common sewers, do not perhaps less require the assistance of enlightened physicians than of able architects and engineers*;" and in fact many of the most important meliorations which at different periods have been introduced in respect to the construction and management of those works of artificial convenience that are the gradual growth of refinement in luxury, have been suggested by individuals who have made the study of the living œconomy their more especial pursuit or profession.

I shall now conclude by addressing a few words to the reader who may be about commencing a series of studies in order to qualify himself for the practice of medicine.

You are preparing to engage in a laborious and to a man of sensibility a most painful vocation; in the exercise of which many circumstances of perplexity will present themselves, which can only be made known by actual experience. Difficulties and intricacies will indeed be pointed out in the courses which you attend, and described in the writings you are directed to peruse; but these, in comparison to what you will be taught in the school of experience, are scarcely more than the delineated roads on a geographer's map, to the perils the traveller encounters. Be studious then to anticipate as much as possible, which will be in effect to lessen, the intricacies of actual practice, by making every case that is pointed out to you by the hospital physician, or clinical professor, in a manner your own. Repeatedly put this question to yourself: What should I do in this instance, were my individual responsibility concerned---were the life of this patient entrusted to my care?

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* Sketch of the Revolutions of Medical Science, by M. Cabanis.

By such reflective kind of attention, if I may employ the phrase, you will profit more in a few months than by years of mere passive reliance on the precepts and practice of your instructors; and, when you come to the bedside of your own patient, you will have less cause to wish yourself again in the wards of the infirmary, like those who with the feelings of manhood regret that they cannot re-live the days of their youth;—a feeling which I believe is much more common among conscientious practitioners of medicine than it would be politic to confess. Often do they desire one small year further of scholastic instruction, which it appears to them would be more than equivalent to the many that were consumed; and, averse as I am to innovation, for innovation's sake, I cannot help supposing that a little more pains taken by the public preceptors of youth in this particular, I mean with respect to the *mode* of acquiring efficient medical knowledge, would serve to diminish materially that source of regret to which I now allude. Medicine perhaps is still taught too much in the manner of an abstract science.

With respect to elementary acquirements, I would earnestly recommend that while your attention is principally, it be not exclusively, devoted to the several branches of study which are regarded as more especially and properly parts of medical education. The professor of the healing art ought to be equally liberal in knowledge and in sentiment; and, in fact, there is no part of science, physical or moral, but which, under proper regulation, and in a due degree, may be made subservient, nay is actually necessary to perfection in medicine.

On points of doctrine and subjects of speculation, equally avoid the extremes of implicit confidence or captious scepticism. Be careful not to reject facts in the pride and obstinacy of system, but do not on the other hand consider an unsystematic accumulation of facts to be the sole object of science. As little is performed without order, so little is acquired without method; and system, in its proper signification, is only the *order* of acquisition; so much so, indeed, that all our advances in knowledge are in one sense reducible to mere improvements in our modes of arrangement. Science is the book-keeping,—the register of facts.

When you come into practice, let your liberal conduct give the lie to those who conceive the profession to be merely craft. Neither encourage a spirit of self depreciation, nor seek to acquire a surreptitious fame. Avoid the pedantic peculiarities of the mannerist, but recollect at the same time that manner may often be made lawfully to act in aid of medicine. "Philosophic and effective practice," it has been rightly said, "involves more than a mere acquaintance with the rules of medicinal prescription." It will be for you often "to read in the human heart, as well as to recognize the presence of the febrile state,"---"to pour oil into the wounds of the mind," as well as to prescribe for the maladies of the body; and let me promise that a conscientious and manly discharge of the important duties of your calling, will prove an ample reward for all your pains, by bringing with it the purest of pleasures---the consciousness of doing good. Farewell.

THE END.

ERRATA.

Page 34, line 3d from the bottom, dele the word *to.*

Page 42, line 1st, for ἐνορμῖον read ἐνορμῶν.

Page 96, line 2d, from the bottom, insert *the oxygen* between the words *mass*, and *gives*.

Page 139, line 7th, for *foulness* read *fairness.*